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MUSEUM,

Register, Journal,

AND

GAZETTE,

JANUARY 3RD — JUNE 26TH, 1852.

EDITED BY J. C. ROBERTSON.

VOL. LVI.

"There is a God within us, says Ovid, who breathes that divine fire by which we are animated. Poets have in all ages advanced this claim to inspiration. There is not, however, anything supernatural in the case. The fire is not kindled from heaven; it runs along the earth; is caught from one breast to another; and burns the brightest where the materials are best prepared and most happily disposed."—HUME.

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1852.

ALPHABETICAL LIST OF NEW PATENTS GRANTED FOR ENGLAND, SCOTLAND, AND IRELAND.

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Adams	Roads and ways, buildings, bridges, &c....	....	4 Dec.	....	19
Addenbrooke ..	Envelopes	8 Jan.	....	....	40
Aikman	Finishing fabrics	20 Jan.	6 Jan.	....	79,119
Applegath	Printing machinery......	....	22 Nov.	....	20
Archer	Preventing railway accidents	24 March	....	....	259
Archibald......	Brick and stone machinery	8 Jan.	....	....	40
Armitage	Safety envelope	8 May	....	....	400
Arnoux	Railway carriages	24 June	....	....	519
Ashworth......	Preventing incrustation...	....	26 Nov.	....	19
Baggs	Crushing gold quartz....	29 Jan.	....	....	100
Bain........	Electric telegraphs, clocks, &c..........	29 May	....	....	459
Bainbridge	Obtaining power from fluids	22 May	....	....	440
Banes	Apparatus for cables of vessels	23 Feb.	....	....	179
Barbe	Reproducing designs	12 Feb.	....	....	140
Bareau	Carpets, velvets, &c.	8 March	....	....	220
Barlow........	Rotary engines, ...	....	22 March	....	260
Barnett	Grinding grain	8 Jan.	13 April	22 March	40,359 360
Barlow........	Preparing hemp and flax..	....	....	5 April	360
Beasley	Metal tubes and forms ..	10 June	....	....	480
Beauvalet......	Iron and steel	12 June	....	....	500
Bell	Sulphuric acid...........	24 March	28 April	....	259,459
Beltzung	Bottles and jars	15 April	19 April	....	319,360
Bentall........	Ploughs	25 March	....	....	259
Bentall and Howard ..	Chilling cast iron........	22 April	....	....	340
Bernard	Boots and shoes.........	27 Jan.	....	....	100
Bernard	Leather and skins	....	10 May	....	459
Bessemer......	Saccharine fluids........	24 Feb.	3 March	....	179,259
Blair	Beds, couches, &c.	....	9 March	....	259
Boulton	Metallic ores, &c........	23 Feb.	....	....	179
Bourcart	Preparing, combing and spinning wool.......	27 March	....	....	279
Brady	Helmets, cartridge boxes, &c.........	22 March	....	....	259
Brandeis	Sugar	12 June	....	....	500
Bridson	Stretching and drying fabrics............	1 May	....	....	380
Brindley	Buttons and flocked fabrics	27 Jan.	....	....	100
Booth	Gas	8 May	....	....	399
Brookes and Jones.....	Stoves and heating apparatus...........	24 Mr.	....	....	259

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Name.	Subject.	England.	Scotland.	Ireland.	Page.
Dickison	Textile fabrics	....	22 Dec.	....	20
Dix	Ventilating	27 Jan.	....	....	100
Dixon and Dodson	Quarrying and working slate and stone	12 June	....	....	500
Donlan	Treating seeds of flax	10 June	....	....	480
Dray	Reaping machines	27 Jan.	....	....	100
Duncan	Steam engines	....	22 March	....	260
Duncan and Hutton	Casks	27 Jan.	6 Feb.	....	100,179
Dupré and Le Sueur	Preventing Smoky Chimneys	17 April	....	....	339
Duthoit	Plastic product	12 Jan.	....	....	60
Elce and Bond	Preparing cotton	26 Feb.	....	....	179
Ellison	Imitation, marbles, &c.	8 March	....	....	220
Ellwood	Hats	....	26 Nov.	....	19
Ermen	Finishing thread	....	8 Dec.	....	19
Ewing	Horticultural construction	....	11 May	....	460
Exall	Bread and biscuits	27 April	....	....	359
Fairbairn and Horsman	Preparing flax and hemp	8 May	17 May	....	400,460
Farina	Paper	13 Jan.	26 Dec.	....	60,119
Feather and Driver	Screws	9 Feb.	....	....	139
Fisher	Ornamenting fabrics	29 April	....	....	359
Fletcher	Stretching fabrics	29 April	....	....	359
Fontainemoreau	Fibrous substances	20 Jan.	....	....	79
Fontainemoreau	Railways and locomotives	22 Jan.	....	....	80
Fontainemoreau	Printing presses	24 Jan.	....	....	100
Fontainemoreau	Gas-burners	23 Feb.	26 Feb.	....	179,259
Forder	Fenders	8 March	....	....	219
Forfar	Ventilation	....	29 March	....	359
Fox	Umbrellas and parasols	6 April	....	....	300
Froggatt	Waterproofing	31 Dec.	....	....	19
Froggatt	Decorative painting	20 March	....	....	259
Gardiner	Metal pipes, shafts, &c.	....	10 March	....	259
Gathercole	Envelopes	24 Jan.	8 Jan.	....	100,119
Gatling	Seeding grain	4 May	....	....	380
Gee	Roasting coffee and cocoa	1 May	....	....	380
Gervoy	Prolonging durability of rails	13 Feb.	....	....	160
Gibson	Pulverizing land	....	....	3 Jan.	120
Giffard	Fire-arms	6 April	19 April	....	300,360
Gilbee	Cutting corks	1 June	....	....	459
Gillespie	Levelling instrument	8 May	5 May	....	400,459
Gillett	Ploughs	17 April	....	....	339
Glynn and Appel	Treating paper	....	1 March	16 March	259,280
Goodfellow	Steam boilers	11 March	....	....	220
Goodman	Ornamenting japanned wares	29 April	....	....	359
Gorman	Motive power	....	20 April	....	360
Graham	Zinc ores	8 March	....	....	219
Granara	Lubricating machinery	....	14 May	....	460
Gratrix	Producing designs	8 June	....	....	480
Greenstreet	Coating & ornamenting zinc	31 Dec.	29 Dec.	....	19,119

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Ridley	Cutting and reaping machines	9 Feb.	....	....	139
Robertson	Printing dyes	....	20 Feb.	....	180
Roberts	Agricultural instruments	31 Jan.	....	....	119
Roberts	Galvanic batteries	10 Feb.	19 April	....	139,359
Roberts	Regulating fluids	....	16 April	....	359
Roberts	Boats, ships, and vessels	22 May	....	....	440
Robinson	Wood moulding	29 April	....	....	359
Rose	Steam boilers	....	9 Jan.	6 Feb.	119,180
Rosenborg	Casks and barrels	....	2 Jan.	10 Feb.	119,180
Russell	Coating metal tubes	22 May	....	....	440
Ruzé	Hat plush	22 May	....	....	440
Saillant	Articles of dress	8 May	....	....	400
Schiele	Motive power	12 Feb.	....	....	140
Schroeder	Sugar and evaporating	....	29 Dec.	....	20
Scott	Wheels, springs, &c.	8 March	....	....	219
Scott	Omnibuses	....	15 March	....	259
Sears	Guns, cannons and cartridges	....	26 April	....	459
Seely	Flour	15 April	....	....	320
Siebe	Paper	1 May	....	....	380
Siemens	Fluid meter	15 April	15 April	....	319,359
Simmons and Walker	Ordnance and carriages	29 April	....	....	359
Simons	Lighting	27 Jan.	....	....	100
Sinclair	Locks	....	8 March	....	259
Sisco	Chains	....	....	23 Jan.	120
Sleigh	Motive power engine	8 March	....	....	220
Smith	Steering ships	13 Jan.	....	....	60
Smith	Violins	27 Jan.	....	....	100
Smith	Cutting lump sugar	29 Jan.	....	....	100
Smith	Steam boiler gauges	....	4 Feb.	....	179
Smith and Smith	Telegraphic apparatus	8 March	....	....	220
Smith	Steam engines	25 March	....	....	259
Smith	Wax candles	1 May	....	....	380
Spencer	Springs	2 Feb.	....	....	119
Squire	Pianofortes	31 Jan.	....	....	219
Stacy	Reaping and mowing machines	24 Jan.	....	....	100
Stenson	Iron and steam apparatus	....	30 Jan.	....	179
Stephens	Motive power	12 Feb.	....	....	140
Stevens	Lamp glasses	22 April	....	....	340
Stierba	Furnaces and heating	22 May	....	....	440
Stopperton	Propelling vessels	....	28 Jan.	....	179
Storthert	Manure	17 April	....	....	339
Sturges	Ornamenting metals	24 Jan.	....	....	100
Sturges	Ornamenting fabrics	29 May	....	....	459
Sturges	Weaving looms	25 Feb.	8 April	31 Mar.	179,359 360
Swan	Figured surfaces and printing	24 June	....	....	519
Swarbrick	Retorts	22 May	....	....	440
Symington, Finlayson and Reid	Flues, heating air, &c.	22 March	22 March	....	259,260

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Tate	Dwelling houses, &c.	....	....	2 Dec.	20
Taylor	Ships, boats and vessels	8 May	....	....	399
Taylor and Frasi	Heating water for baths	27 April	....	....	359
Thomas	Soap	1 May	....	....	380
Thomas	Steam generators	....	5 May	....	459
Thompson	Filtering water	2 Feb.	....	....	119
Thompson and Hewit	Spinning, doubling and twisting	27 March	....	....	279
Tizard	Treatment of grain	8 May	....	....	400
Torr	Reburning animal charcoal	3 Feb.	26 Jan.	17 May	119,179 460
Townend	Textile fabrics	8 June	....	....	480
Trotman	Fountains	9 Feb.	....	....	139
Trotman	Anchors	20 April	....	....	340
Trueman and Cameron	Obtaining copper	4 March	....	....	200
Turck	Rosin oil	14 Feb.	18 Feb.	24 Feb.	160,179 280
Tyer	Electric communication	22 Jan.	....	....	80
Underhay	Regulating supply of water	8 March	....	....	219
Van Kempen	Refrigeration	8 March	....	....	220
Varillat	Extracts	....	....	15 March	280
Von Herz	Preserving roots and plants	29 May	....	....	459
Wagstaff	Candles	20 Jan.	....	....	79
Walker	Mariners' compass	23 Feb.	....	....	179
Walker	Steam engines	23 Feb.	....	....	179
Walker	Vacuum pans	25 May	....	....	440
Wanbrough and Turner	Flocked fabricks	8 March	....	....	219
Warden	Carpets	24 June	....	....	519
Warren	Railways, railway carriages, and paving	....	13 Jan.	....	119
Watt	Decomposing saline substances	....	....	22 Dec.	120
Watt	Treating flax and hemp	22 May	17 May	....	439,459
Webster	Regulating draft	25 May	....	....	440
Wheatley	Safety-cab omnibus	18 March	....	....	240
White and White	Shipbuilding	24 March	....	....	259
Whitehead and Diggle	Bleaching, dyeing, &c.	20 Jan.	....	....	79
Whitehead	Preparing, combing, and drawing wool	29 March	....	....	279
Whytock	Printing yarns, weaving, &c.	....	24 Feb.	....	19
Wilkinson	Ships and other pumps	3 March	....	....	200
Williams	Building compositions	30 Jan.	....	....	119
Willis	Winding yarns	1 June	....	....	459
Wilson and Wilson	Preparation of wool	22 Jan.	26 Jan.	17 May	80,179 460
Wilson, Wilson, Childs and Jackson	Presses, matting, fatty matters, &c.	....	....	19 Dec	20

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TO THE FIFTY-SIXTH VOLUME.

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BLACK'S REGISTERED PAPER-CUTTING MACHINE.

Fig. 1.

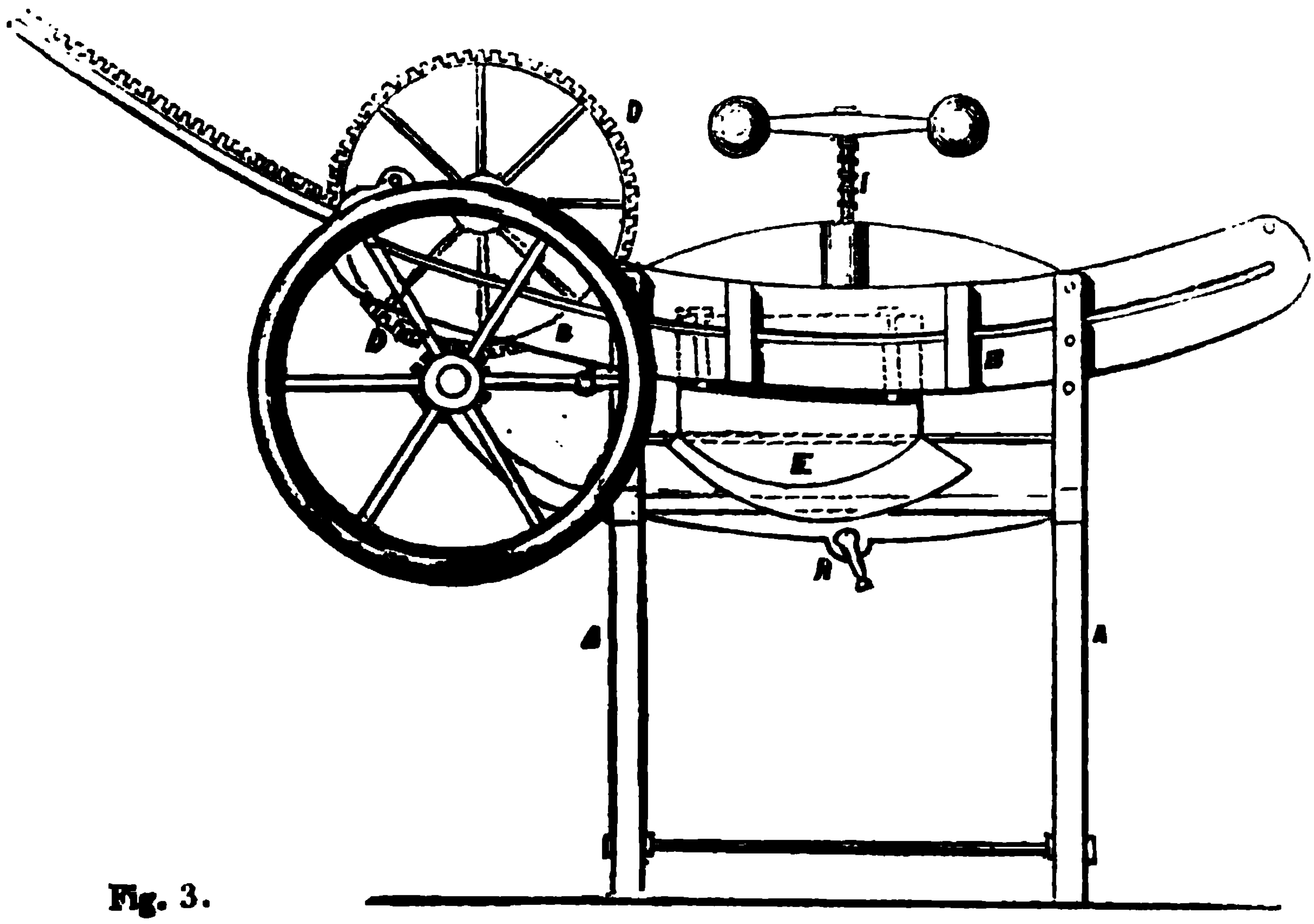


Fig. 3.

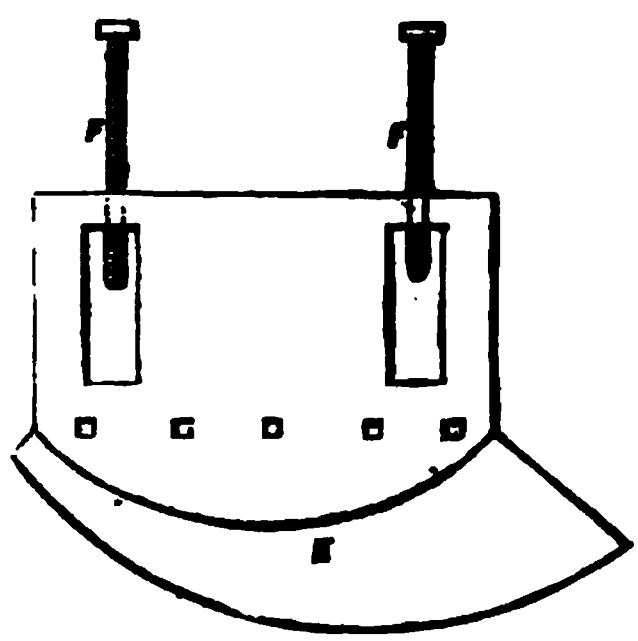
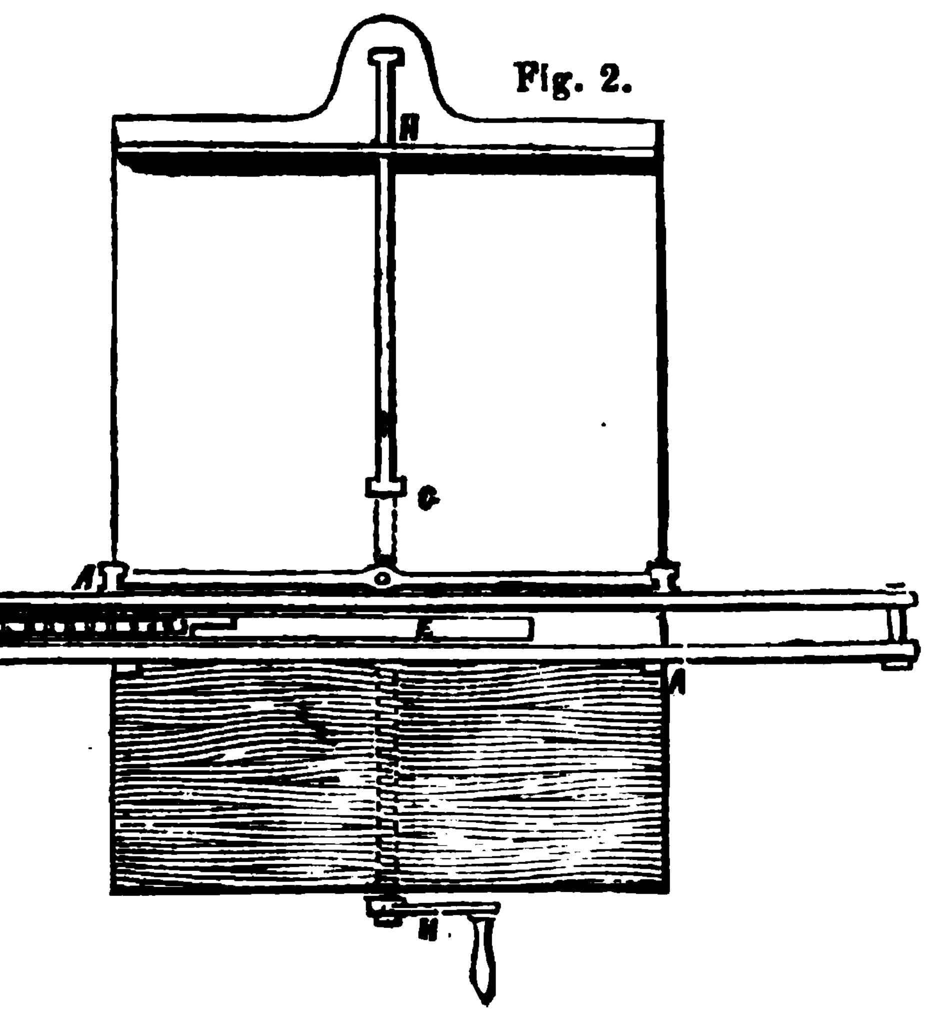


Fig. 2.



BLACK'S REGISTERED PAPER-CUTTING MACHINE.

Mr. Black, whose-paper *folding* machine attracted such favourable notice at the Great Exhibition (see vol. lv., p. 101,) has now applied his ingenuity with equal success to the production of the paper *cutting* machine represented by the engravings on the preceding page. Fig. 1 is a front elevation; and fig. 2 a part plan of this machine. AA is the framework. BB are two slotted circular segments which form the front rails of the framework. C is a rack which rests upon the segments B B, and within which it is free to slide backward and forward when acted upon by the wheel gearing D D. E is the cutting knife which is affixed to the rack C, and is made to traverse across the front of the machine by the motion of the rack. JJ (fig. 3), are screws by which the knife is raised or lowered. G is the bed upon which the paper to be cut is laid; and H a screw spindle by which the bed is adjusted. I is the screw by which the paper is held in a fixed position; and K the back-plate which is hinged at its lower edge, so that it may be brought by means of pinching-screws to a proper position for the paper being cut rectangularly.

THE PHILOSOPHY OF BOOK-KEEPING.

On preparing for the Committee, now sitting at Portsmouth on Accounts, a note for their information, of Sir Samuel Bentham's official and other papers on that subject, it appeared that many of his observations are as applicable to private as to public concerns, and as the prosperity of private ones—manufacturing and commercial—greatly depends on the accuracy with which statements are kept of all outgoings and incomings,—as his discussions on the subject enter into it more logically than is usual in considering it,—and as they tend to the introduction of reason and simplicity in book-keeping,—the following extracts from his observations have been made in consideration of their practical value: they are taken principally from his letter to Sir Henry Parnell, Bart., M.P., which was published in the year 1830, under the title of "Financial Reform Scrutinized," but which has been long out of print.

It may be well to premise that Sir Samuel's attention was directed to the vicious mode of keeping accounts in naval arsenals so early as the year 1796, when he was Inspector-General of Naval Works—that, from that period, during the whole of the naval administrations of Earls Spencer and St. Vincent, their lordships successively requested him to give his attention to the devising a new system of management for naval arsenals, in preference to all other business which could well be postponed,—that, in the system he devised in consequence, besides the introduction of individual responsibility throughout all the departments subordinate to the Board of Admiralty, all participation in the accountant branch should be withdrawn from operative officers, thus affording a check upon their transactions,—and that measures were taken for preventing the possibility of concocting on the spot any account whatever, so as to make it exhibit transactions in any other than their true light. The plan of such a reform was stated by the Lords Commissioners of the Admiralty to be in considerable forwardness when they made their Report to the Lords of the Privy Council, in 1801, but was finally lost sight of in the course of the successive changes that took place in naval administration, and by the abolition of the office of Inspector-General of Naval Works; but in the formation of that plan he had investigated the subject of book-keeping, both as practised in public establishments and in private manufacturing and commercial concerns.

In "Financial Reform Scrutinized," the preparatory observation was made that he had extended his views to the receipt and expenditure of the largest sums and of the smallest—"considering each sum expended as being paid in exchange for the acquisition of some article of the *materiel*, or for some service of the *personnel.*"

The words *materiel* and *personnel* have as yet been applied solely to the *public* service; but as there are no terms in the English language for expressing the great division of expenditure for *things* and for *services*, it would seem a

convenience to adopt generally the words *materiel* and *personnel* in private no less than in public accounts.

Sir Samuel having stated the ends it is desirable to attain in public accounts, says what is equally desirable in private ones—that "it is essential that the form of all accounts, and the manner of keeping them, should be such as that for the performance of the several operations—from the first registering a fact to the making the last general abstracts,—the least degree of skill, as well as the least consumption of time, and consequently the least expense, should be required. Moreover, the form in which the accounts are kept should be the best suited for reference;—the language should be the most intelligible to persons of all descriptions."

"Considering that money's-worth, no less than money, should be the subject of public accounts, and that the loss by extravagance, waste, embezzlement, and theft, in relation to a number of articles of the *materiel*, far exceeds any losses that have been sustained by the public in the form of cash, it will appear that the actual transfer of cash from hand to hand * * is but the secondary and very inferior consideration in regard to the savings to be effected by reform."

Although losses of the kinds thus indicated are far from so considerable in private concerns as in our naval arsenals, yet in private manufactories it would also greatly tend to the diminution of waste and misapplication of materials and labour, were accounts habitually kept of all unprofitable outgoings; and the above-mentioned fundamental principles are equally applicable to the most extensive concerns and to those of the pettiest dealer or manufacturer.

Sir Samuel recommends that, in regard to vouchers for the receipt of money or stores, Government should take a lesson from private persons, and require nothing more than a *receipt* in the common form, and he gives many instances of the inefficacy of a plurality of signatures. Private manufacturers are not likely to fall into errors of this nature; but his mode of paying operatives seems the most simple that has yet been devised—where wages have to be distributed to considerable numbers. Money having been obtained, on acknowledgment by simple receipt given for it to the local cashier, "the master workman, or a distributor chosen by the workmen themselves, having thus obtained the cash, would distribute it to the several workmen under him—their silence on the subject of pay, after the known customary time of distribution, being in regard to them considered as proof that they had been duly paid. This mode of payment I first introduced in the three manufacturing establishments at Portsmouth, began and carried on for many years under my direction.* The wages were thus paid weekly sometimes to the amount of about 5,000*l*. a year, amongst about 90 or 100 operatives, by the master of the Metal-Mills, *after* working hours; and payments were made in the same manner in the two other of those establishments—the Wood-Mills and the Millwright's shop, during the whole time they were under my management. * * I should add, that during the whole time these establishments were under my direction, no instance of difficulty, inconvenience, or loss of any working time resulted from this mode; when, by the former mode, besides the whole extra expense of pay-clerks, the value of the operatives' time lost on pay-days, only in the Dockyards, did not amount to less than 1,000*l*. a year."

Employer and employed were equally benefited by these regulations. The employed, instead of borrowing money at exorbitant interest to satisfy his

* "On this first occasion of mentioning the three new establishments in Portsmouth Dockyard, I must observe that they were withdrawn from all influence of the system of aggregate management. The Navy Board happened to perceive that under that management, and by means of the persons subject to their order, the businesses in question could not be introduced; and though a Board, they in this instance informed the Admiralty that they saw no alternative to the putting them under my sole management,—subject only to my individual responsibility."

To this Note of Sir Samuel's may be added, that the forms of accounts he introduced were so simple and so intelligible, that not a single clerk was required for making entries of receipts and disbursements in any of the three establishments. In the Wood-Mills, for example, a lad at 1s. 2d. a day, acting as cabin keeper, also sufficed, with the master of the mills, to make all the necessary entries. Yet these were no small concerns; for during the seven years Sir Samuel was the sole manager of them, not less than a million sterling of the public money passed through his hands on their account; and the savings effected by them amounted in the Wood-Mills to upwards of 20,000*l*. per annum, probably nearer 30,000*l*.; and in the Metal-Mills they (the savings) were proved to have exceeded the large sum of 40,000*l*. a year.

daily needs, as was dockyard practice, had weekly cash in hand wherewith to go to the cheapest ready-money market; consequently, a lesser amount of wages procured for the operative an equal quantity of necessaries. Morally, this arrangement was of far greater import; it saved the men from the need of incurring debt—a practice which, when once entered on, too often leads to ruin. Weekly payments have the same good effect in private concerns also. As to the time for payment being *after* working hours, this was established on the principle that the employer is entitled to the labour of the employed for the whole of the hours specified as working hours, be they more or less. Many a misunderstanding between masters and men would be spared in private concerns, were this simple fact clearly stated to the operatives, and rigidly adhered to: it does not prescribe the *number* of working hours—that should be left to private agreement between master and men: it does not forbid the accordance of a holiday occasionally, nor hinder the master from bestowing a gratuity on the deserving; it is merely a part of that openness which is so desirable, and in the end so profitable to all concerned. The arrangements at the Crystal Palace for paying the operatives in erecting it, are said to have been excellent; but if it be true that one clerk had to pay the many hundreds of men employed, much of their time must have been needlessly consumed; whereas had the money been handed by him, in the first instance, to distributors—say one for every twenty men—19-20th's of the clerk's time would have been saved to the employer, and, on an average, as much to the men themselves.

A very satisfactory regulation in these three establishments was copied from the practice in a private manufactory, where between 2,000 and 3,000 hands were employed. On the day before pay-day an account was given to each operative of what he had earned by piece-work in the week; the operatives thus had leisure to satisfy themselves as to the accuracy of the accountant: if doubted, the men were allowed to state their objections; but it very rarely happened that, after conning over the account at home, they were not fully satisfied of the accuracy of the statement. Thus all squabblings and delays were avoided at pay-time, and the people were convinced that they had received their due.

Many late losses—not only to Government, but also to individuals—from the defalcation of persons holding money in trust, render interesting Sir Samuel's observations as to the kind of *security* desirable. A modification of that which he recommends in public establishments, might be applicable to the holders of deposits on private account—as, for example, those in savings-banks, benefit societies, &c. He says, "A degree of security in regard to the money-trust reposed might be obtained far beyond what is usual, by adopting in this country a precaution taken in France in regard to all public officers entrusted with the receipt or payment of Government money; that is, requiring the officer to give security to the amount thought requisite—not the *vague* security of personal friends engaging to be answerable for deficiencies, but a real, never-failing, and immediate security; namely, the depositing, on their appointment to office, a certain large sum in the public funds, the interest of which they duly continue to receive so long as they are honest and correct; but the capital, or the requisite part of it, becomes the property of Government in case of defalcation. * * An objection that might be made to this mode of obtaining security, might proceed from an idea of hardship on the persons appointed as cashiers, if they had not a sufficient disposable capital of their own. But in answer to this, it must be observed, that no such difficulty is experienced in France; money is always to be borrowed by private persons on good security, and it may be added, that a man whose probity is doubted by his private friends, can hardly be considered as a proper person to be entrusted by Government."

In this letter to Sir H. Parnell, as on all other occasions, he lays great stress on the importance of requiring but a *single* signature, in contradistinction to a plurality of signatures, and gives many instances of official oversight where the names of several officers were required to sign a money-bill; but it is not necessary to adduce these examples, as it is not usual in private concerns for three partners, or three anybody's, to put their

names every quarter to a salary bill before their clerk can be paid his quarter's salary.

"In judging," he says, "of the fitness of the manner of keeping accounts of public expenditure, it has of late been very usual to refer to the manner of keeping them by individuals in their private concerns; but in making this reference, it has been more in regard to the *form* (which I shall consider farther on, under the head of book-keeping) than to the *use* of accounts, or to the matter that should enter into them, to which attention has been paid."

"There are essential differences between the objects of public departments and those of private merchants or manufacturers. The ultimate object of the private concern is that of producing profit as measured by *money*. The *effects* which is the ultimate object of public concerns to produce, however valuable they may be, or essential to the prosperity and even existence of the country, and however desirable it may be that a money value should be set upon them, yet they are seldom expressed by a measure in money. The private proprietor of any concern employs the capital under his command with no other end in view than that of increasing his profit; all the accounts of private concerns must be supposed, therefore, to be so arranged as that the last abstract should exhibit the profits or loss resulting from the concern in *money*; whilst, on the other hand, in a public concern, the capital being employed in producing the *effects* above mentioned, the accounts must be so arranged as that the last abstract should exhibit what *effect* has been produced by the expenditure of a certain capital."

"The merchant trading with a capital of 100,000*l*., possesses at the end of the year, over and above the return of his capital, a surplus or profit suppose of 10,000*l*. The naval department, with a capital of 100,000*l*., has, by the end of the year, exchanged that capital for various items which have, for instance, entered into the composition of a ship of the line, fitted, rigged, and armed ready for sea. In the mercantile concern, good or bad management will be shown by the quantity of money that has been produced over and above the capital employed; in the public concern, good or bad management will be shown by the comparatively lesser or greater sum of money that has been expended for the obtainment of the ship of the line."

"* * Whilst the private account shows the difference in money between the prime cost and the produce or sale price of the articles bought and sold, or manufactured and sold, the Government account must show whether the cost of the article purchased or manufactured exceeded or fell short of the cost of the same article obtained by any other means. This will be exhibited by a comparison of the accounts of the different modes in which the same article has been obtained at different times, in different places, under the influence of different circumstances, and under the management of different persons. In this view it appears that Government accountants have, in regard to subordinate transactions, to keep accounts of most of the items which enter habitually into a manufacturer's or merchant's accounts; whilst the *abstracted* accounts, as they ascend from the inferior branches to the highest, must essentially differ from mercantile accounts. Instead of mere *profit and loss*, indication must be given of effects produced — absolute expenditure compared to efficiency, and consumption of time in the production of effects, with a view to the general objects of efficiency, economy, and dispatch."

So immense a sum is now invested in Joint-stock Companies, and those Companies resembling Government establishments in many points of management, the foregoing abstract is given on that account; it indicates various items that might profitably be laid before shareholders;—that, by good management, the cost of additions to the rolling stock of a railway company, for instance, had been less than on former occasions;—that, by judicious regulations, the service, at a reduced expense, was as well or better performed than formerly;—would be more convincing if proved by figures than it can be by the most able speech at a general meeting. Such an habitual comparison, too, of "absolute expenditure compared with efficiency" would, doubtless, be of essential service to the managers of such concerns; it would place before them at one view such part of the affairs under their direction as might need particular attention. In

fact, such abstracts are made *mentally* by private merchants and manufacturers, but they would be found still more useful if regularly written down, ready for consultation when purchases or sales have to be determined on; and would be highly satisfactory to *dormant* partners in the many cases in which there are such.

"Interest of money," says the letter, "is an item which is well known to enter regularly and habitually into the calculations and accounts respecting all mercantile and manufacturing transactions, but which, in regard to public expenditure, in the instance of the naval department, at least, and, I believe, equally in other departments, seems not to have been noticed, excepting, indeed, occasionally relative to cash in the hands of treasurers and paymasters, and sometimes where Government have had to pay interest for money advanced on account. * * * This loss, as existing in public concerns, will be found to be immense; it is a loss which I first exhibited to the view of the superior naval authority so long ago as the year 1796; I also indicated it to the Committee on Finance in the year 1798, who seemed very sensible of the importance of it, and I have not failed to endeavour to draw attention to it by the indication of losses and display of savings dependant on interest of money on every occasion that presented itself, down to my last official statement in the year 1813."*

As interest of money is so habitually taken into account in private concerns, the above quotation is in fact superfluous here; yet considering the great and increasing influence which the industrial portion of the community has in national affairs, its insertion may have its use in pointing out the means by which an immense amount of public expenditure might be saved, and that without injury to any individual, or diminution of national necessaries, or even luxuries. On this subject the pamphlet itself, "Financial Reform Scrutinized," might be worth consulting, and the copy of it in the Library of the United Service Museum, is more easily accessible than that in the British Museum.

(*To be continued.*)

* "Naval Papers," No. VIII., page 18. To this must be added one of his very last communications to the Admiralty, January, 1851.

THE FIRE AT MESSRS. COLLARDS'.

Again, an instance where twenty or thirty thousand pound's-worth of property might have been saved from conflagration had the example been followed which was set in the Portsmouth Wood-mills half a century ago, and which has been so often described and adverted to in the *Mechanics' Magazine*. The Messrs. Collards' great piano-forte manufactory has been burnt down, though (it is said) that when the fire was first discovered, it was confined to a couple of work-benches. Had there been in this building pipes and hose leading from a reservoir of water on the roof, as in the Portsmouth Wood-mills, the burning benches might immediately have been drenched with water, and thus, in all probability, extension of the flames have been prevented.

This conflagration at the Messrs. Collards' is said to have been extremely rapid by reason of the air rushing up the two staircases, in addition to that supplied by a large open space from top to bottom in the centre of the building. The air from these several air-shafts caused the flames to play round and round the interior of the structure with irrepressible fury.

Such a central well affords great convenience both for the elevation and descent of goods, and for inspection of the several workshops on the panopticon principle, thus rendering a similar convenience desirable in many an extensive manufactory; but there can be no reason for leaving that well open at night from top to bottom, or for not providing means for closing it at pleasure at the level of each floor by day as well as night. In the Albion-mills, destroyed by fire some sixty years ago, there was a similar well for hoisting up sacks of corn, and at the level of each floor there was a trap-door which every sack opened as it rose, and the flaps fell again of themselves as soon as the sack had passed. Here was a useless loss of power in opening the trap for every successive sack, and the flaps being of wood afforded little security against fire; but surely in such buildings it would be well worth providing flaps of metal, inclosing some slowly-conducting matter—tile, for example,—and capable of being open or shut at pleasure.

As to staircases, it has already been

suggested in Nos. 1355 and 1439 of the *Mechanics' Magazine*, that they should be in many cases external instead of, as is customary, within the building itself. For a circular building, especially, the projection requisite for this accommodation might easily be designed so as to break the monotony of the circle, and to afford a grace to the whole structure. Appearance should, in fact, be but a secondary consideration in manufacturing buildings, but when beauty can be given without inconvenience or extra cost, there can be no reason for not affording it. In point of convenience, an external staircase might be constructed so as to give every facility for internal communication. Supposing the factory to be circular, a single passage from the staircase on each floor leading to its centre might communicate with a central gallery opening to all the radial workshops. The requisite quantum of passage-way might thus be less in amount than in the usual mode. Were a double stair desirable, an example was exhibited in the Crystal Palace of a means of affording it in a single block.

This late disaster has shown the inefficiency of concrete as a fire-proof material when exposed to long-continued intense heat; for although at the Messrs. Collards' factory the concrete floor stood firm and undecomposed for many hours, the calcareous part of it was burnt to lime by the excessive heat above it, so that this floor at length gave way, and fire amongst the materials under it broke out afresh.

Ascertainment of the best materials for floors in a manufactory, and the best mode of constructing them, are still *desiderata*. The disaster at Messrs. Collard's has shown that concrete is not to be depended on; all floors constructed with bricks, solid or hollow, if they be united by means of a calcareous cement, are liable to destruction by fire by the burning of the calcareous matter to lime; floors paved with, or composed of, plates of metal have been found unhealthy to operatives, on account of the rapid heat conducting power of all metals. Would the contraction and expansion of a metal floor by different degrees of heat be too considerable to admit of laying tiles in cement upon it?

M. S. B.

CHIMNEY-SWEEPING IN PETERSBURGH.

The St. Petersburgh mode of sweeping chimneys is in many respects preferable to that practised in London. The St. Petersburgh apparatus used for this purpose consists of a long, very flexible rope, to one end of which a ball of iron is attached, and, an inch or two above the ball, a long cylindrical brush surrounds the rope. The chimney-sweeper finds his way, with this apparatus, to the roof of a house from its outside, and there introduces the apparatus into the chimney to be cleansed. The weight of the ball carries the brush downwards, more or less swiftly, according to the rapidity with which rope is furnished by the operator. If the soot be not sufficiently swept down by a single descent of the brush, it is drawn up again, and the operation is repeated as often as needful.*

The superiority of this mode of sweeping chimneys chiefly arises from its being little injurious to the shaft, the ball having no angles to disturb pargetting or brickwork; whereas where rods are used to force the brush up, they grate against and materially injure the shaft; indeed, in an instance which lately occurred, even a brick was displaced by them: the mischief done was fortunately discovered by the issue of smoke from the kitchen-chimney into the drawing-room from behind the skirting-board.

It might not be easy to gain access from without to the chimney of a high town house; but even were sweeps to ascend by its stairs to the roof, less dirt would be made than when they, with their rods and brushes, are admitted to the interior of rooms. A chimney has lately been twice swept downwards from the roof successfully by means of the common brush and rods. The register of the stove having been previously shut down, much less dirt was occasioned than usual on sweeping the chimney; even dimity curtains in the room were not soiled. On this occasion, the housemaid removed the soot swept down; but, at any rate, this part of the business might be done by a clean, instead of a sooty boy.

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* This is also the practice in Edinburgh, where the great height of the houses is very favourable to its adoption.—Ed. M. M.

The master chimney-sweeper, when first requested to have the chimney swept from above, expressed a fear that the brush would prevent the escape of air upwards, and consequently would force soot into the chamber. This did not prove so on trial; but inconvenience from this cause might be prevented by a suitable formation of the brush; it might be made with a spiral vacuity around the rope, through which vacuity air would escape upwards, instead of being compressed in the lower part of a chimney-shaft.

A GLANCE BACKWARD.

Sir, — Perhaps the first volume of your Magazine appears older to one who was born years after it was printed than to others who may remember reading its pages fresh from the press.

It will, however, be interesting to all your correspondents to observe the infancy of inventions now matured, but then only struggling into daylight, and the strange medley of subjects which, twenty-six years ago, occupied the attention of the ingenious.

I shall make a hasty run through your first Volume, and note the remarkable difference which is so apparent between the nascent mechanics of that day and the chimeras, nostrums, and paradoxes which occupy its pages, and the stern, business-like division-of-labour species of articles which more modern years have brought forth.

In the first Number we have "flying machines," perfect, according to the inventor,—needing only to be treated leniently, because they do not carry more than six months' provisions aboard! Then comes "tea and teapots" and a "cure for a cold" (*apropos* of the aëro-navigator). A diving-bell (at least *two* elements subjugated) and a test for separating cotton from wool, which, by the way, if applied would, strangely enough, produce "gun-cotton."

Six new patents are heralded as the production of three weeks, and, at present, the same number are brought forth in as many days, despite the strangling of our precious patent laws.

No. 3 announces another balloon. I see that our fathers were quite as airy as their sons.

Witty *bon-mots*, now the rightful property of *Punch*, enliven No. 4; but the *utile cum dulci* is kept up by a first description of the well-known Mackintosh cloth.

Brunel's proposed tunnel appears in No. 5, and Chubb's "Anti-Yankee" lock is brought to notice.

No. 6 defends the aforesaid light reading by an answer to some stiff patentee who objected to mechanics being sweetened by wit.

The subject of the Mechanics' Institution, broached in No. 7, occupies deservedly a large space in succeeding numbers. A few pages written now upon this matter would be worthy of consideration.

No. 8 is quite colloquial;—domestic medicine and poetry, varied with social talk and recipes—corns, colds, and rheumatics—varnishes, pickles, and rhyme.

The Meteorological Society is wafted into No. 9, and a volley of perpetual motions is launched in the next number.

The balloonists bid high for fame in No. 14, and expound a sage proposal for living "a whole year in the clouds."

No. 19 descends to earth again, in a suggestion for an iron railway; and we are borne to the regions of the impossible by a wight who strains at squaring the circle only a fortnight afterwards.

Of course, there is a brother heretic, who believes that he can trisect an angle, and boldly says so in No. 22; but before the moon has waned, there happily comes to the rescue a proposal for stereotype printing—solidly heavy and dull—inestimably practical and enduring.

No. 25 has a grand woodcut, which proves (on paper) that power can be gained by a multiplication of cog-wheels! disheartening discovery, indeed, to the sober correspondent who had spent letter after letter in enunciating truth. Another cycle will be finished, and *we* shall be judged by the men of 1880, who will despise steam as "out of date," look on railways as antiquities, smile at the notion of women wearing petticoats, or men covering their heads with chimney-pot hats.

I am, Sir, yours, &c.,

JOHN MACGREGOR.

From and after the 31st of December, now just past, the offices of the Clerks of Signet and Privy Seal are by the 14th and 15th Vic., c. lxxxii., abolished; and "no Queen's Bill, Signet Bill, or Privy Seal Bill," will now be requisite as heretofore preparatory to the passing of Letters Patent under the Great Seal. All that is to be henceforth necessary (after the Attorney or Solicitor-General has reported in favour of a Patent being granted) is a "Warrant under the Royal Sign Manual," addressed to the Lord Chancellor, commanding the Patent to be sealed. Assuming that the *fees* will follow the fate of the abolished offices (about which, however, some doubts have been expressed, though not shared in by ourselves) the exact saving to the patentees on each English patent will be about 18*l.*; thus reducing the total cost from 110*l.* to about 92*l.* The cost of Irish and Scotch Patents will not be affected by the change, but remain as heretofore.

The 2nd and 3rd of February next promise to be busy days in patent matters at the Privy Council-office. Not only does the hearing then come off of the application for the prolongation of Lowe's Screw Patent, but the hearing of a similar application by Sir William Burnett in respect of his Wood Preserving Patent, which, if not prolonged, will expire on the 26th of July, 1853. Lowe's application is opposed by a host of interested parties, and the fate of it is looked forward to with very general concern—screw steaming having recently sprung into unwonted favour, not only with the shipping interest, but also with Government, and its progress being sure to be more or less impeded or accelerated by the fate of the patent in question. The prospect of a revival of Sir Wm. Burnett's patent is regarded on the contrary, without apprehension or uneasiness. It is thought, no doubt, that the medical knight well deserves all the profit he can get by his patent; and that as there are other good preserving processes besides his in the market, there is no fear of his being able to establish by the renewal of his patent anything like a monopoly price in the matter of timber-preserving. Lowe's patent has the fault of being so vast in its scope (how legitimately and fairly we shall presently see) that it quite stops the way—not for mere rivals, with claims no more exact and definite than his own (which might be fair enough) but of a number of independent inventors and improvers, who have nothing in common with Lowe, but that their object is the same. What would the gentlemen of the turf say to a brewer's horse being placed across the course on the Derby Day, simply to disturb by his unwieldy bulk the rush—of their Eclipses and Flying Dutchmen to the goal?

For the 2nd of July there also stands the hearing before the Privy Council of an application by Thomas Ridgway Bridson of Bolton-le-Moors, and John Mangnall of Sharples, for the prolongation of a patent dated May 27, 1838, granted to Mr. Bridson and William Letham (since deceased) for "certain improvements in machinery or apparatus for stretching, drying, and finishing woven fabrics."

In answer to a correspondent who has addressed to us a feeling letter on the subject of this last patent, it may be sufficient to say, that if the representatives of the deceased William Letham can show to the Privy Council (which it is open to them to do) that the deceased and his family have not received a fair remuneration for his share of merit in the invention, the Council will *not grant* the renewal without accompanying a provision to that effect. For evidence of this, it is sufficient to call to mind the case of Russell and Whitehouse, which *quoad hoc* is thus reported by Mr. Webster:

The assignment to Mr. Russell was put in; it contained a clause securing to Mr. Whitehouse an annuity of 300*l.* It was suggested by one of their Lordships that, as the extension of the term would occasion considerable additional profits, the inventor should have a larger annuity secured to him. Mr. Fletcher (after conferring with Mr. Whitehouse) put in an agreement, signed by him in behalf of Mr. Russell, to secure to Whitehouse an annuity of 500*l.* during the existence of the patent.

Effect was given to this suggestion of their Lordships and the undertaking of Mr. Fletcher by the new Letters Patent, reciting that the Judicial Committee of the Privy Council had recommended an extension of the term of the said Letters Patent for six years upon Mr. Russell securing the said annuity to Whitehouse. The securing this annuity was further recited as part of the consideration of the grant of the new Letters Patent to Russell; and then there was, among other provisos, a proviso that the said new Letters be void if the said Russell should not secure the annuity to Whitehouse so long as the said new Letters Patent should last.

CHESTERMAN'S DOUBLE CONTRACTING AND EXPANDING SPANNER.

(Registered under the Act for the Protection of Articles of Utility. James Chesterman, of Sheffield, Machinist, Proprietor.)

Fig. 1.

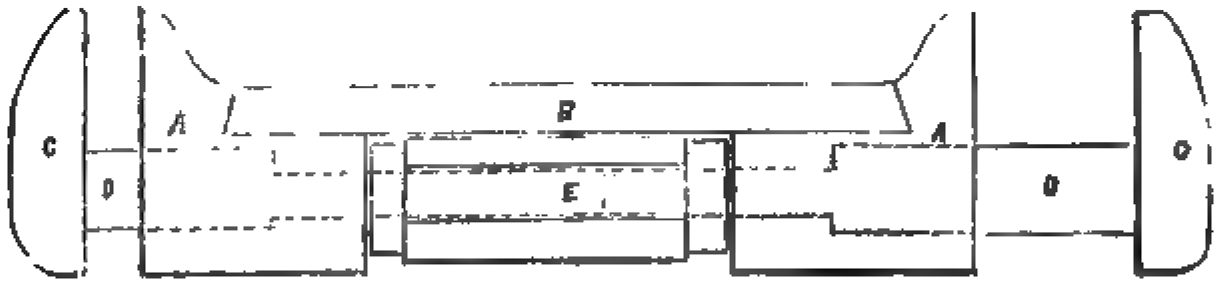

Fig. 2

Mr. Chesterman, who has already acquired a great name in our workshops for his improvements in tools, especially those of the brace and spanner class (see vols. lii., pp. 398, 470; lv., p. 450), has now registered another of the same class, which is not exceeded by any of its predecessors for ingenuity and extensive usefulness. It is a tool of double action—both contracting and expanding at the same time, and by virtue of one movement; that is to say, expanding at one end and contracting at the other. Fig. 1 is an external elevation, and fig. 2 a longitudinal section of this spanner. A A are two jaws, which are connected together by an intermediate piece B; C C are another pair of jaws, which form the terminations of two slides D D, which take into sockets formed in the jaws A A. Each of the slides D D terminates in a screw F, and these screws F F are simultaneously moved by means of a coupling hand-nut E, common to both; so that when the hand-nut E is turned, it enlarges the grip for taking hold of the nut at one end of the spanner, while it correspondingly contracts that at the other end.

DESCRIPTION OF A NEW METHOD OF PREPARING NEGATIVE PHOTOGRAPHIC PAPER. BY M. GUSTAVE LEGRAY.

(Translated from the *Moniteur Industriel*, for the *Mechanics' Magazine*.)

Persons who are engaged in the process of photography on paper are well aware of the difficulty of obtaining paper of a good quality and suitably adapted to receive uniformly the requisite chemical preparations.

After having made a great number of trials, I have succeeded in meeting this difficulty by the use of a size adapted, I may say, to any kind of paper.

Paper thus prepared so much facilitates the photographic process, and helps to assure a satisfactory result, that I make no doubt it will be generally adopted.

The substance used for this size is virgin wax, which is kept at a temperature of 100° centigrade, in a large flat vessel, and the paper is immersed therein until completely saturated with the wax. The sheet of paper is then withdrawn, and laid between several pieces of blotting-paper, over which a moderately heated iron is passed, which causes the blotting-paper to absorb the superfluous wax. If the paper is properly prepared, there will be no gloss whatever on its surface, and it will be perfectly transparent.

The waxed paper is then immersed in a warm solution composed as follows:

1000 parts of rice water.

40	parts of	sugar of milk.
15	do	iodide of potassium.
0·80	do	cyanide of potassium.
0·50	do	fluoride of potassium.

The sheet of paper should be laid in this solution for half an hour, and it may then be withdrawn and hung up to dry.

The paper is then immersed in a clear solution of aceto-nitrate of silver, which is thus formed:

300	parts	distilled water.
20	do	azotate of silver.
24	do	crystallizable acetic acid.
5	do	animal charcoal.

The animal charcoal serves to render the paper more susceptible to receive impressions, and decolourises the solutions when they have been previously used. The paper should remain three minutes in this solution, and in order to insure contact with the liquid, the two sides of the sheet should be rubbed over with a brush. The paper is then washed several times with distilled water, and well-dried between pieces of blotting-paper. Paper thus prepared may be taken immediately into the dark chamber, and it is not necessary to subject the image to the action of gallic acid on its removal from the camera; this may be deferred till the evening, or even the next day, or the day following.

The paper may be kept in a dark place for more than a fortnight without undergoing any alteration, and in this respect offers greater advantages than any of the photographic papers hitherto known. The solution of gallic acid is composed of 1 part of gallic acid, half part (0·5) of azotate of silver, and 200 parts of distilled water. The image is fixed as usual by hydrosulphite of soda.

I have submitted to the Academy a series of specimens obtained by this process. It is so easily put in practice that, during a mission which I have just fulfilled for the Commission of Historical Monuments, I have often taken twenty-five or thirty photographs a day.

THE STEREOSCOPE.

The phenomena of vision have engaged the attention of our must acute philosophers; and various have been the theories propounded to explain the result of single vision with a pair of eyes, which are of necessity under the influence of two impressions. The researches of Wheatstone have done more than those of any other man to place this phenomenon in a clear light. In his stereoscope we survey two images viewed at the angle of reflexion converted into a *solid* body,—that is, a body conveying to the mind an impression of *length*, *breadth*, and *thickness*. This instrument has recently been modified by Sir David Brewster; who, by cutting a lens into halves, and placing each half so as to represent an eye—the distance between them being 2½ inches—has very beautifully imitated the mechanical conditions of the eye. Such an instrument is used as a camera for photographic purposes; and daguerreotypes obtained in it, as we have seen them executed with great delicacy by Mr. Claudet, are examined under a similar instrument, the binocular stereoscope. The result is, a mimic reality of the most deceptive character.

We have looked at views of the Crystal Palace and its varied wonders in this little instrument—which does not very much differ in appearance from an opera glass—extending the whole length—every object represented in three dimensions, groups of figures, statues, &c.—which have been copied by the daguerreotype, but copied at slightly different angles, to correspond with the difference between the two eyes,—and which, when looked at under ordinary conditions, present mere flat pictures, correct in perspective and light and shade. They become in the stereoscope beautifully raised, in the highest relief, standing out from the surface as *perfect solids* to the deceived sense. Mr. Claudet is actively engaged in applying this instrument to portraiture; and it is curious to survey a group of portraits in the stereoscope, each one standing apart from every other, and all exhibiting the rotundity of life.

Professor Wheatstone has just carried his inquiries a step further; and in the invention of the *pseudoscope* shown how the senses may convey false impressions to the mind.—*Athenæum.*

RECENT AMERICAN PATENTS FOR IMPROVEMENTS IN TEXTILE MANUFACTURES AND MACHINERY.

(From Report of Mr. Fitzgerald, Examiner, American Patent-office, for 1850.)

About seventy patents belonging to this interesting class, have been granted within the last year. Improvements in these branches of manufacture appear to be without limit, and notwithstanding all that has been done, the tide of useful and valuable inventions is still onward. Machinery for fibrous and textile operations requires a degree of perfection which is demanded in but few branches of the arts, and it con-

sists of so many parts and combinations, and so much of it is of an extremely complicated character, as to afford the most ample room for improvement, and the time requisite to bring other branches of machinery to their full maturity is scarcely sufficient to conduct this out of its infancy. Much as has been done in this class, and wonderful as its improvements have already been, every year makes numerous and important additions and gives promise of more astonishing developments in future. This class includes every variety of machinery which is necessary for reducing the various kinds of fibrous materials to perfect fabrics.

But three patents have been granted within the year for improvements in cotton gins. One of these machines has a plate with teeth at its end, passing between the saws, and is placed in a horizontal position behind the grate, and is combined with a brush operating upon the fibres in the saws, to remove the dust and conduct it off upon the plate. The other has a series of small rollers grooved lengthwise, each having a portion removed from its side arranged around a toothed cylinder. These small rollers revolve slowly as the toothed cylinder revolves, and prevent the bolls which rest against them, from passing, while the toothed cylinder takes the cotton from the seeds. When the side of the small cylinder, from which a part has been removed, comes opposite to the toothed rollers, if the boll is sufficiently reduced, it will be carried to the next roller, when the seeds will be still further stripped, and so on, to the completion of the operation. Brushes are prepared to take the fibre from the toothed cylinder. A third machine delivers the cotton in endless bats.

Hemp and Flax.— Four patents have been granted within the year for improvements in machinery for preparing hemp and flax, which do not require particular description. In one of them there is a device for separating and drawing out the fibres, so that it may be spun like cotton.

Carding.—About four patents have been granted for improvements in carding machines. In one of them the main cylinder has, in addition to its usual motion, a reciprocating end motion, for the purpose of more perfectly spreading the staple over its surface. In another, a band armed with card teeth works constantly across the cylinder near the doffer, for the purpose of crossing the fibres to produce a bat proper for felting. In a third, wires are connected to good conductors, and with the teeth which operate upon the wool, for the purpose of preventing injurious electrical action. A process of mixing wool and cotton on the cards has also been patented. Each staple is prepared on separate machines until both are ready for the finisher, when they are carried together through the cards and mixed.

Letters Patent have also been granted for improvements in apparatus for sizing and drying cotton batting, and for improved apparatus for making hat bodies. They do not greatly differ from such as have heretofore been known.

Spinning and Twisting.—About fifteen patents have been granted within the year for improvements in these subdivisions; one for improvements in the counter twist speeder. Its object is to prevent the irregular and unsteady motion of the roller upon which the roving is wound. Another is for an improvement in drawing regulators. It performs substantially the same duty as some already in use, but in a different way. The regulating apparatus is governed by the trumpet as in some other machines. A patent has been granted for improvements in cop spinning. It is a new arrangement of devices for regulating the winding of the yarn in the cop. A combination has also been patented to be used in doubling and twisting, and for stopping the machine when either of the threads break. An improvement has also been patented for use in doubling and twisting silk. It is for holding and releasing the threads, and consists of a bar with a series of spring catches closed by independent springs, but opened simultaneously by a sliding sluated bar—or each may be opened at pleasure, without the intervention of the bar. By this device the operation is much facilitated. A hand spinner has also been patented, which is a slight modification of others in use. A device for regulating the tension of yarn in spooling, has also been patented; and also two or three machines for making cordage, which are said to answer a good purpose.

Patents have been granted for a knitting machine, for improvements in the manufacture of rugs, folding cloth, shearing cloth, pressing hats, and for other miscellaneous purposes.

Sewing Machines.—No less than seven patents have been granted within the last year for improvements in sewing machines; it is but a few years since these machines were introduced, but as they are found to be useful, inventive genius is already directed in no small degree towards them, and important improvements may be expected. In one of these machines, the needle lies in a groove made in the face of a straight rack, and is held in this position. A pinion works

into the rack upon which the cloth is laid—the pinion being at the point of the needle. When the pinion is turned, it at once crimps and carries forward the cloth upon the needle, and discharges the cloth by a reverse motion with the seam sewed. The eye of the needle is near its point. In another of these machines, the cloth is placed upon the plate of metal lying over an opening in the table, and perforated for the passage of the needle. The needle is forced through the cloth and the plate, by appropriate machinery. The thread is placed under the plate upon a bobbin, and when the needle is down, by an appropriate motion of parts in connection with the bobbin, the thread is thrown round the needle, which has a notch to hold it, and is drawn through as the needle is withdrawn, and forms a loop on the upper side. The cloth is then fed forward, and the needle is again forced through the cloth and plate, and through the last-mentioned loop. The thread is again wound upon the hook of the needle, and drawn up through the cloth and the loop through which the needle previously passed, and by a continued repetition of these operations, the seam is perfected. Several of these machines make the seam with two threads, one of which passing through the eye of the needle (which is at its point), is at every stitch carried through the cloth, forming a loop on the opposite side. A shuttle having a thread passed through the loop, and as the needle returns its thread, is drawn down upon the shuttle thread, which prevents it from being drawn through. I cannot go fully into the details of these machines; they are adapted to various circumstances, and make their seams by a variety of stitches.

Looms.—About twenty-five patents have been granted within the year for improvements in the different varieties of loom. An unusual degree of attention has been bestowed upon those which have reference to weaving piled fabrics. No less than six patents have been granted for improvements in the manufacture of this variety of fabric. In one of these looms two figuring wires are used, entering the fabric on opposite sides, operated by vibrating arms, and supported by guides at each side. In this manner, the wires may be made about half as long as would otherwise be necessary. Thus, the binding of the wire in the act of insertion is in a great measure prevented. Or these wires may be made of the full length, and inserted and withdrawn alternately, so that one will remain in the fabric, while the other is withdrawn and re-inserted. When such warps are used that two wires will be sufficient, the operation will be much facilitated by this modification. In another of these looms, when two fabrics are woven together, and connected by the threads which are to form the nap, a kind of grate is used to guide the fabrics as they are woven, and to keep them always at an equal distance apart. This device also enables the knife to separate the fabrics in such a manner as to leave the nap or pile of uniform length. In another of these looms, the guides which support the wires, are composed of jaws which rise and close, leaving a series of small openings through which the wires pass for the purpose of being more perfectly guided, and which open and descend, leaving the wire after it has been properly inserted. In another of these looms, a knife is made to pass below the breast beam which cuts the pile, allowing at each cut one of the wires to be released and to fall into a trough below. An arm extends from the knife holder into this trough, and pushes the last wire, which was released to the left of the loom, and then leaving it in a trough, and two endless belts with hooks work into the trough, taking the wire and carrying it up above the lay, at the left end of which there is a trough to receive it, opposite the end of the lay. In this trough there is a follower moving lengthwise of it, which pushes the wire into the shed, there being a row of notches in the front sides of the dents of the reed to guide the wire. Thus the wires are inserted, and as the fabric is woven, the pile is cut and the wires returned for re-insertion.

Letters Patent have also been granted for improvements in looms for weaving fabrics with small figures. It has not the compass of a Jacquard loom, but it is less complicated, and much more easily adapted to different varieties of figures. The loom has sufficient compass to answer its appropriate purposes, and avoids some disadvantages in working the harness with the Jacquard, without sacrificing any of its advantages which are important in weaving the kind of fabrics for which this loom is intended. Patents have been granted for improvements in throwing the shuttle; for making wire heddles; for sizing twine heddles, and for protecting the reed when the shuttle fails to enter the shuttle-box. A hand-loom has also been patented, in which all the motions are derived *directly* from fixtures connected with the lay, and for a temple to be used in weaving seemless fabrics.

Other improvements in looms, apparently of great value, have been patented, but neither time nor the complicated nature of this variety of machinery will justify a further analysis of this class.

GOLD REFINING.

Most of the native gold brought to the American mint for refining, contains silver, from which it must be separated before it can be supplied with the uniform proportion of alloy required by law in gold coin. For this purpose, the process now in use throughout the world, is to melt the gold to be refined previous to coining it, with two to three times its weight of silver. It is then granulated and exposed to the action of hot nitric or sulphuric acid, which dissolves out nearly all the silver, both that in the native metal and that added by the refiner, and thus leaves the gold in nearly a pure state, and ready to receive the necessary portion of alloy required in the gold coin. It will be seen at a glance, that allowing a million of California gold to weigh 53,250 ounces, or nearly two tons, it would require nearly six tons, or 161,250 ounces of silver, and worth about 190,000 dollars, to be kept constantly on hand to work it. The desideratum is, therefore, to find some process of working the gold by which this great outlay of silver may be prevented, and by which greater celerity may be effected; both of these results, the inventors of the two following processes allege they have obtained.

In the first, the argentiferous gold is converted into the chloride by the action of nascent nitro-muriatic acid generated by the reaction of sulphuric acid upon a mixture of nitrate of soda and common salt, or by other equivalent means. The silver contained in the native gold is also converted into the chloride by the same chemical reaction, and it is prevented from incrusting the gold by the more intense affinity, and the agitation produced by a jet of steam, which is constantly being forced into it. The gold is next precipitated in the metallic state upon the chloride of silver, by means of pulverized copperas. After washing the precipitate of gold and chloride of silver, the latter is reduced to the metallic state by the reaction of zinc and dilute sulphuric acid; and, subsequently, the silver is dissolved out by means of nitric acid. From the nitrate of silver obtained above, the metal in the pure state is precipitated in the usual way, by the reaction of zinc and dilute sulphuric acid.

In the second patent referred to, the design of the invention is to avoid the use of chloride in the first part of the process. The argentiferous gold is first melted down with zinc or other metal baser than silver, from which alloy the baser metal may be dissolved out by dilute sulphuric or other cheap acid, and the bullion pulverized; or an alloy of great brittleness made, which may be easily crushed or broken down by mechanical means, so as to fit the gold bullion for the direct action of nitric or other acid. The inventor states, that he first mixes the argentiferous gold with twice or three times its weight of zinc, melts and stirs well the alloy, and then granulates the same by pouring it into water. The alloy thus obtained, is next treated in wooden vessels lined with lead, with dilute sulphuric acid, which removes the zinc, and leaves the argentiferous gold in a finely-divided pulverulent or spongy state. In this second operation, heat is not required, and but little more sulphuric acid than will be necessary to form the sulphate of zinc.

Third. The argentiferous gold thus reduced to a spongy state, and still containing the silver untouched by the reagents used, is treated with hot nitric or sulphuric acid (the sulphate of zinc having been first entirely removed by washing), by which the silver is entirely removed, and to be obtained in a metallic state, as in the former process, or in the usual way. Finally, the operation is finished by cupelling the gold, or melting it with such fluxes as borax, nitre, &c., and casting it into bars.—*American Patent Office Report*, 1850-51.

ON THE VELOCITY OF LIGHT.

The state of Arago's sight has recently induced him to resign the carrying out of his proposition of submitting the two rival theories of light to experimental decision to physicists gifted with younger eyes. It is well known, that, according to the theory of Newton, the so-called *emission theory*—the velocity of light in passing from a rarer medium into a denser is *increased*. For example, the index of refraction in passing from air to water is $\frac{4}{3}$; according to the emission theory, the velocity of light in air is to its velocity in water as 3 is to 4. Opposed to this stands the theory of undulation, proposed by Huyghens, and supported by Euler, Young, and Fresnel. According to this theory, the velocity of light in passing from a rarer to a denser medium is *diminished*; in the case of air and water, for instance, the above ratio is reversed; the velocity of light in air is to its velocity in water, in the ratio of 4 : 3. The genius of Fresnel has won for the latter theory almost universal recognition; a direct proof was, however, wanting, and this urged Arago* to the hardy thought of submitting the question to an experimental test.

The rotating mirror of Mr. Wheatstone

* It ought to be mentioned, that the same subject had occupied the attention of Sir John Herschel and Mr. Wheatstone some years before it

was proposed as the instrumental agent for carrying out this idea. If we conceive a ray of light to enter a dark room through a hole in a window-shutter, and to fall upon the plane surface of a reflecting mirror set perpendicular to the direction of the light, the latter will be sent back along the path by which it entered. If the reflecting surface be oblique to the direction of the light, the latter will be reflected in some other direction; supposing a second reflecting mirror to be set perpendicular to this latter direction, the light will be reflected from this in the direction of the perpendicular, will again strike the other mirror, and be finally sent back by the latter through the aperture by which it entered. In this case the ray suffers two reflexions from the intermediate mirror; and if it be true that light requires time in passing from one point to another, these two reflexions *cannot occur contemporaneously*. A certain portion of time, however small, will be required for the journey to and fro from one mirror to the other. Supposing, for instance, the mirrors to be placed six feet apart; the light proceeding from the aperture is received upon the first mirror and reflected by it on to the other; from this it is reflected back again, and thus accomplishes a journey of twelve feet between its two reflexions by the first mirror. To this journey, as has been said, time is necessary. If the aperture and the two mirrors be perfectly motionless, the path of the light in coming, will coincide with its path in returning; but if, while on its route *between the two mirrors*, we conceive the position of the first mirror to be changed, that, for instance, it has become more inclined to the direction of the ray, the latter will not be reflected in the line of its approach, but will be thrown against the window-shutter more or less to the side of the aperture. This change in the position of the mirror during the almost infinitesimal portion of time occupied by the light on its twelve feet journey, is accomplished by imparting to the mirror a high angular velocity, say a thousand revolutions in a second. We here find ourselves in possession of a means of comparing the velocity of light in air with its velocity in water. When the mirror rotates, the ray sent back does not strike upon the aperture, but more or less to the side of it. The less time occupied by the light in performing its double journey between the two mirrors, the less ought this divergence to be, and *vice versâ*. Hence, if the Newtonian theory be true, the introduction of a column of water six feet long ought to bring the reflected image of the aperture *nearer* to the aperture itself; and if the undulation theory be true, the introduction of such a column ought to make the divergence *greater*. These speculations have been recently submitted to the test of experiment, and the result has pronounced in favour of the theory of undulation.

Of course, such experiments, though easily described, and simple enough in principle, demand considerable delicacy of manipulation. The divergence spoken of is in reality exceedingly small. In order to observe it, M. Foucault has made use of a square aperture furnished with a number of vertical bars of fine platinum wire; eleven of these fitted in the space of one millimetre, and between each two there was a small space through which the light entered. The image given by this was a small field furrowed with alternate black and white stripes. The light, after entering through this aperture, fell upon a lens, by which it was converged, but before it came to a focus on the opposite side it fell upon the rotating mirror; it was thence cast upon a concave mirror placed about six feet distant, which reflected it back again. By a peculiar artifice, M. Foucault was enabled to compare with great nicety the divergence of the black and white stripes in the image from the platinum wires and their intervening spaces. "I have already proved," says M. Foucault, "by two successive operations, *that the deviation of the image after the journey of the light through air is less than after its journey through water*. I have also made another confirmatory experiment, which consists in observing an image formed partly by light which has passed through air, and partly by light which has passed through water. For small velocities, the stripes of this mixed image were apparently continuations of each other. *But by the acceleration of the motion the image is transported, and the stripes are broken at the point of junction of the air image with the water image. The stripes of the latter take the advance in the sense of the general deviation. Further, on taking into account the length of water and of air traversed, the deviations are found to be proportional to the indices of refraction.* These results indicate a velocity of the light *which is less in water than in air*, and, according to the views of M. Arago, fully establish the theory of undulation."

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was mooted by Arago; and a proposition was actually made by the former to send a bar of light through a tube of water or alcohol a mile in length, and thus determine the influence of this medium. This idea, though not so practical, is the same in principle as that of Arago. The latter, however, was not aware that any such proposition had ever been made.

EXTENDED APPLICATION OF AUXILIARY STEAM SCREW POWER TO MEN-OF-WAR.

The Lords of the Admiralty have at length decided on applying auxiliary screw propellers and steam engines to all our principal men-of-war. The first to be thus fitted is the *Royal Albert*, of 120 guns, which has been just finished (after being ten years on the stocks), and is supposed to be the largest ship ever built for the Royal Navy. Besides the *Royal Albert*, there are three other ships in the course of being fitted out with screws; namely, the *Sanspareil*, of 100 guns; the *James Watt*, 80; and *Agamemnon*, 80.

Artificial Magnet.—At a late meeting of the Ashmolean Society, at Oxford University, Mr. Walker exhibited one of the artificial magnets manufactured by M. Elias, of Haarlem, of a very powerful nature, as to the amount of weight it would lift; and also remarkable for its virtue not being weakened by the sudden disruption of the keeper from the magnet, a quality not found in other magnets. M. Elias has obtained great celebrity by his magnets; the steel after being brought into the form of the bar, or horse-shoe, is passed through a coil of covered copper wire, one end of which is connected with the positive pole of a voltaic battery, and the other end to the negative pole, when in action, thus making it an electro-magnet, by the current of electricity passing through the wire. The magnet is moved backwards and forwards within the coil, and it is to be observed that the connection must be broken when the centre of the magnet is in the coil. The magnet exhibited by Mr. Walker was composed of three horse-shoe magnets, forming a compound one; its weight was about 10 lbs. or 12 lbs., and required 84 lbs. to separate the keeper from it.

The Planing of Iron and Casting of Glass.—Messrs. Hawks and Crawshay, of the Gateshead Iron-works, have just completed, for Messrs. R. W. Swinburne and Co., plate-glass manufacturers, South Shields, a huge plate of planed cast-iron, to be used for the casting of glass. It is, we believe, the largest and heaviest plate of iron that was ever planed. Its dimensions are—length, 18 feet 4 inches; breadth, 10 ft. 10 in.; breadth, 7½ in.; and its weight is 26 tons. Mr. Hosking, Messrs. Hawks and Crawshay's engineer, constructed a planing machine for the express purpose for executing the work; and it has the peculiarity of cutting both ways. A smooth surface and a dead level have been obtained—great merits in a plate for glass casting; for the more perfect the level, the less the labour that is required, and the danger that is incurred, in communicating an even and polished surface to the glass. A small plate, weighing 20 tons (also intended for Messrs. Swinburne's works), will shortly be placed in the machine.—*Gateshead Observer.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING DECEMBER 31, 1851.

PROSPER DURAND, of the Maragrand, Paris, merchant. *For improvements in communicating intelligence.* Patent dated June 17, 1851.

These improvements are exemplified by what the patentee calls a dioramic advertiser. It consists of an endless curtain or sheet, having advertisements or devices printed or painted thereon. The sheet is supported by two rollers in a vertical or inclined position, which are geared together so as to revolve in the same direction; and when the rollers are set in motion the sheet is caused to traverse the front of the apparatus, presenting every part of its surface in succession. The sheet is made of a number of separate pieces, each with its own advertisement, which are sewn together in order to admit of their being readily removed and replaced by others.

Claim.—A combination of parts into an apparatus, with which a moveable curtain of indefinite length and width is used.

GEORGE JORDAN FIRMIN, of Lambeth-street, Goodman's-fields, manufacturing chemist. *For improvements in the manufacture of oxalate of potash.* Patent dated June 24, 1851.

These improvements consist in manufacturing oxalate of potash by employing oxalic acid and water to act on salts of potash, such as the tartrate, sulphate or muriate of potash.

When tartrate of potash is the salt employed, the patentee takes cream of tartar, and neutralizes the excess of acid contained in it by the addition of carbonate of lime; he thus obtains a neutral tartrate in solution to every 100 lbs. of which he adds 60 lbs. of crystallized oxalic acid dissolved in water. This quantity of acid is sufficient to combine with about half of the potash; the remaining half being acted on by the liberated tartaric acid and converted to tartrate of potash, which may serve for a subsequent operation, or may be purified by passing its solution through animal charcoal. The neutral oxalate of potash is subsequently treated by adding a sufficient quantity of oxalic acid to convert it to a superoxalate, which is

filtered, evaporated, and crystallized in the ordinary manner.

In operating on sulphate of potash the patentee dissolves it in water, heated to about 180° Fahr., and to every 100 lbs. thereof he adds 160 lbs. of crystallized oxalic acid dissolved in water, or a sufficient quantity of oxalic acid to convert the potash of the salt into superoxalate of potash (sulphuric acid being liberated). He then stirs the mixture well, keeping up the temperature to about 180° Fahr., and allows it to cool, when the superoxalate of potash will be found adhering to the sides and bottom of the vessel. It is subsequently dissolved, filtered, evaporated and crystallized in the usual manner.

When muriate of potash is operated on, the patentee dissolves it in water, heated to about 180° Fahr., and having added to every 100 lbs. thereof 140 lbs. of crystallized oxalic acid dissolved in water, or a sufficient quantity of acid to convert the potash of the salt to a superoxalate, he proceeds as above directed when operating on sulphate of potash. The muriatic acid resulting from this process may be utilized by evaporating the liquor left in the vessels after the crystals of superoxalate of potash have been removed, and the residue of the evaporation may be returned to be again operated on with fresh quantities of muriate. In order to prevent the escape of muriatic acid, it is recommended to conduct the operation in a closed vessel (which should be composed of earthenware, although lead vessels may be used when operating on the tartrate and sulphate of potash), having a pipe leading from it to another vessel containing water, by which the water will be absorbed.

Claim.—The manufacture of oxalate of potash by employing oxalic acid and water to act on salts of potash as described.

RICHARD EDWARD HODGES, of Southampton-row, gentleman, and WILLIAM BROCKEDON, of Devonshire-street, gentleman. *For improvements in surgical instruments.* Patent dated June 24, 1851.

The instruments specified under this patent are of two classes; *firstly,* instruments to be introduced into an orifice or passage, which are so constructed that they shall be capable of expanding when so introduced, for the purpose of closing the orifice, or expanding a collapsed passage; *secondly,* instruments in which an exhausted vessel is employed for the purpose of facilitating the discharge of excretions.

Of the first class, the patentees describe; 1st., an instrument adapted for the treatment of stricture of the urethra: it consists of a tube of India-rubber, having a slender rod or tube passed through it and secured at one end to the rod, which has a metal cap at that end. The instrument is used by extending the India rubber tube when introducing it into the passage in its extended state, and allowing it to contract, and consequently increase in diameter, so as to expand the passage. When used for animals, four or more India-rubber tubes arranged around one tube or rod are used, the object being to expand the passage gradually which is done when the tubes are separately released from tension, and allowed to contract to their shortest length; 2nd., a plug for gun-shot wounds, which consists of a short length of tubular or solid India-rubber: this is drawn through the wound in an extended state, and allowed to expand when introduced.

Under the second class, an instrument is described in which an exhausted cup or vessel is used for the purpose above alluded to. The instrument may, by slightly modifying its construction, be adapted for the milking of cows.

Claim.—The construction of surgical instruments as described.

JOHN BRAZIL, of Manchester, gentleman. *For certain improvements in dyeing and in the preparation of dye-woods.* Patent dated June 24, 1851.

The *first* part of this invention consists in using soap or saponaceous matter in water, in order to facilitate the extraction of the colouring principles from madder, garancine, or other dye stuffs in the act or process of dyeing. The proportions which the patentee prefers to employ are half a pound of soap (palm oil soap by preference) to every 10lbs. of madder, with the usual proportions of ground chalk and water. It is recommended to enter the goods to be dyed at a temperature of about 70° to 80° Fahr., which should be gradually raised to 180°, when the goods are withdrawn. Or, instead of using the proportions of soap above mentioned, almost half or two-thirds of the soap liquors used for the first soaping of the fabrics may be employed, and in both cases the madder should be added before entering the fabrics in the dye-beck.

The *second* part of this invention consists in using a solution of borax or borax combined with soap, for the purpose of more readily extracting the colouring principles from madder and other dye stuffs while in the act of dyeing. When borax is used alone, the proportion is ½ lb. to 12 lbs. of madder, and when soap and borax are employed together a quarter of a pound of each are added to 10 lbs. of madder, the usual quantity of ground chalk being introduced in either case.

The *third* improvement consists in saturating piece goods previous to applying a

mordant, with a solution of soap in water, which must be dried in the goods before the mordant is applied. For this purpose the patentee makes a solution of 1 lb. of soap in 12 gallons of water, which will be a proper strength when the goods are entered in a dry state; but when the goods are entered direct from the bleaching vat in a wet state, a liquor of greater strength will be found necessary. The fabrics having been submitted to this operation, are dried and then dyed in the usual manner. Another liquor adapted for the same purpose is composed by adding to the soap water from the soap vat as much resin as it will readily dissolve; this liquor is used in the same way as the former one. A third liquor consists of water to which has been added for every six gallons one pound of borax with as much resin as it will conveniently dissolve.

The *fourth* part of the invention consists in using a solution of soap in water, or of borax alone, or combined with soap, in order to facilitate the extraction of the colouring principles from dye-woods and dye stuffs, the quantity of the above ingredients employed depending on the nature of the dye liquor required to be produced, and the dye-wood which may be under operation.

Alexander Parkes, of Birmingham. *For improvements in separating silver from other metals.* Patent dated June 24, 1851.

These improvements consist in extracting silver from lead by the use of zinc, and in separating the silver so extracted from the zinc employed for that purpose.

In the specification of a former patent dated June 11, 1850 (*see* vol. liii., p. 496), Mr. Parkes described a method of extracting silver from lead ore, by melting the lead and then using zinc in a melted state to combine with the silver contained in the lead. The present improvements consist in employing quantities of zinc varying with the quantities of silver contained in the lead ore under operation. For ore containing 14 oz. of silver to the ton, one part of zinc to every 100 parts of ore will be found a good proportion. This proportion must be varied with the quantity of silver present: thus, there will be required

	Silver.	Zinc.
For a ton of lead ore containing.	14 oz.	22·4 lbs.
Ditto ..	21 ,,	33·6 ,,
Ditto ..	28 ,,	44·8 ,,

and so on.

The lead having been melted, and its temprerature raised to the melting point of zinc, the zinc is introduced, and after being well mixed, time is given to allow the zinc and silver to rise to the surface, and when the metal begins to set, the zinc is skimmed off, and placed aside for the purpose of having the silver extracted from it. The lead which has been thus desilverised will be found to contain a small proportion of zinc, and as this would act prejudicially on the metal, it may be removed by running the lead into a reverberatory furnace, and maintaining a low heat until the zinc is oxidized and rises to the surface; the lead is then tapped off, and the oxide of zinc removed from the furnace by any suitable means. This operation will occupy about two hours to two hours and a quarter, supposing the quantity of lead to be about three tons and the surface about 25 to 30 square feet.

In order to separate the silver from the zinc and lead with which it is combined, it will be necessary to concentrate the alloy, and this is done by placing it in an iron pot perforated at the bottom, and applying a low heat so as to melt out a portion of the lead; the lead which is thus melted out, may be melted again with a fresh quantity of ore to obtain any portion of silver which it may still contain. The concentrated alloy may then be submitted to a low heat, so as to oxidise the zinc and admit of its being dissolved out by muriatic or sulphuric acids, leaving the silver to be subsequently treated in the ordinary manner. Or it may be distilled in a retort, such as is used in the manufacture of oxide of zinc, so as to obtain the zinc in a metallic state, and admit of the silver being separated by cupellation from the small quantity of lead and impurities remaining combined with it. When performing this distilling operation, it will be found advisable to add to the zinc and silver alloy a small quantity of carbon to reduce any oxide which may be present.

John Holmes, of Birmingham, machinist. *For improvements in machinery for cutting and stamping metals.* Patent dated June 24, 1851.

The patentee describes and claims:

1. An arrangement of machinery for punching buttons, rings, steel pens, and other articles from sheets of metal, the peculiarity of which consists in a self-acting feed for drawing the sheet of metal under the action of the punches. The feed consists of a pair of jaws between which the sheet is held, and which receive the necessary motion from a cam-plate worked by an eccentric on the main shaft of the machine.

2. An improved construction of fly-press for manufacturing buttons, &c., in which the die is formed in two parts, the central one being fixed, and the other part acted on by a spring, which forces it outwards after each stroke of the dies, in order to remove the finished button, and thus render the die self-clearing.

RECENT AMERICAN PATENTS.

REVOLVING REVERBERATORY FURNACE. *A. S. Beadleston.*

I claim the rolling or revolving furnace, revolving on friction wheels or rollers, or their equivalent, in combination with an ordinary fire, such as is used in reverberatory furnaces, the two being combined in such a manner that the products of combustion, heated gases, &c., from the grate, shall pass into the interior of the said rolling or revolving furnace, substantially as described, said rolling or revolving furnace, being applicable to any purpose for which ordinary reverberatory or wind furnaces are employed.

CARBONIC ACID ENGINE. *J. C. Salomon.*

Claim.—I do not claim the invention of carbonic acid gas, in its liquified or aëriform character, as a motive power; neither do I claim the use of the hydrostatic press for liquifying the gas, as these principles have long been known and commented upon by Sir H. Davy, Faraday, Brunel, and others; but what I claim is, first, a carbonic-acid gas engine, in which said fluid passes from a reservoir, where it exists in a liquid state, through suitable valves, into a heated cylinder, thence into a refrigerator, where it is condensed by hydrostatic pressure, and forced back again to the reservoir before named, the said engine being constructed substantially as described.

Secondly, the combination of crimped leather washers, a spiral spring or springs, and oil, or any lubricant, for packing the piston-rods or plungers, as described.

PANS FOR WASHING ORES, MINERALS, &c. *Samuel Porter.*

I claim arranging and operating a series of ore washing pans, or sets of pans, in a vibrating frame, said pans or sets of pans, having also an oscillating or rocking motion in the frame, in such a manner that, as the superficial portion of the contents passes freely from any one pan or set of the series, into the next, the contents shall, at the same time, pass out of the latter less freely, or not at all, and *vice versâ*, substantially as described.

Second, I claim also the arranging, in a vibrating frame, of a series of pans or sets of pans, one after the other, each pan or set being hung upon the frame by a separate axle, or equivalent attachment, and secured in its working position by a catch, or other equivalent means, in such a manner that each pan or set may be conveniently disconnected and tilted, so as to discharge its whole contents into a receptacle separate from those of the other pans.

Third, I claim also the arranging of a succession of groups of pans, by a constant duplication, for the subdivision of the contents, in such a manner that the contents issuing from each pan of any one group, the last excepted, shall pass, by an equal division, into two pans of the next succeeding group, substantially as described.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Robert Beck Froggatt, of Sale Moor, Chester, manufacturing analytical chemist, for improvements in the preparation of certain compounds to be used for the purpose of rendering woven and textile fabrics, paper, leather, wood, or other materials or substances waterproof and fire-proof, and also in machinery or apparatus employed therein. December 31; six months.

Francis Hastings Greenstreet, of Albany-street, Mornington-crescent, for improvements in coating and ornamenting zinc. December 31; six months.

George Gwynne, of Hyde Park-square, Middlesex, Esq., and George Fergusson Wilson, managing director of Price's Patent Candle Manufactory, Belmont, Vauxhall, for improvements in treating fatty and oily matters, and in the manufacture of lamps, candles, night-lamps, and soap. December 31; six months.

George Collier, of Halifax, York, mechanic, for improvements in the manufacture of carpets and other fabrics. December 31; six months.

Francis Clark Monatis, of Earlstown, Berwick, builder, for an improved hydraulic syphon. December 31; six months.

David Napier, of Millwall, engineer, for improvements in steam-engines. December 31; six months.

LIST OF SCOTCH PATENTS FROM 22ND OF NOVEMBER, TO THE 22ND OF DECEMBER, 1851.

Richard Whytock, of Edinburgh, for improvements in applying colours to yarns, or threads, and in weaving or producing fabrics when coloured or party-coloured yarns or threads are employed. November 24; six months.

Thomas Crook, of Preston, Lancaster, cotton manufacturer, and James Mason, of Preston, warper, for certain improvements in looms for weaving. November 26; six months.

Thomas Cussons, of Bunhill-row, Middlesex, for improvements in ornamenting woven fabrics for bookbinding and its uses. Nov. 26; six months.

Henry Ellwood, of the firm of Ellwood and Sons, of Great Charlotte-street, Blackfriars-road, Surrey, wholesale hat manufacturers, for improvements in the manufacture of hats, and other coverings for the head. November 26; six months.

John Ashworth, of Bristol, manager of the Great Western Cotton-works, for certain improvements in the method of preventing and removing incrustation in steam boilers and steam generators. November 26; six months.

Joshua Grindrod, of Birkenhead, Chester, consulting engineer, for an improvement in the machinery for communicating motion from steam engines, or other motive power, and in the construction of rudders for vessels. December 1; six months.

William Bridges Adams, of No. 1, Adam-street, Adelphi, Middlesex, engineer, for certain improvements in the construction of roads and ways for the transit of passengers, of materials, and of goods: also in building and in bridges, parts of which improvements are applicable to other like purposes. December 4; six months.

Godfrey Ermen, of Manchester, cotton spinner, for certain improvements in the method of, and apparatus for, finishing yarns or threads. December 8; six months.

James Nasmyth, of Patricroft, Lancaster, engineer, and Herbert Minton, of Stoke-upon-Trent, Stafford, china manufacturer, for certain improve-

ments in machinery or apparatus to be employed in the manufacture of tiles, bricks, and other articles, from disintegrated or pulverized clay. December 11; six months.

Frederick William Norton, of Paisley, Renfrew, North Britain, manufacturer, for certain improvements in the manufacture or production of plain and figured fabrics. December 12; six months.

John Cumming, of Paisley, Renfrew, North Britain, pattern designer, for improvements in the production of surfaces for printing or ornamenting fabrics. December 15; six months.

John Livesey, New Lenton, Nottingham, draughtsman, for improvements in the manufacture of textile fabrics, and in machinery for producing the same. December 15; six months.

Augustus Applegath, of Dartford, Kent, for improvements in machinery used for printing. December 22; six months.

William Dickinson, of Blackburn, Lancaster, machine maker, for certain improvements in machinery or apparatus for manufacturing textile fabrics. December 22; six months.

George Gwynne, of Hyde Park-square, Middlesex, Esq., and George Fergusson Wilson, managing director of Price's Patent Candle Company, of Belmont, Vauxhall, for improvements in treating fatty and oily matters, and in the manufacture of lamps, candles, night lights, and soap. Dec. 22; six months.

Herman Schroeder, of Bristol, gentleman, for improvements in the manufacturing and refining of sugar, which improvements are applicable to evaporating other fluids where a low temperature is advantageous. December 29; six months.

LIST OF IRISH PATENTS FROM 21ST OF NOVEMBER, TO THE 19TH OF DECEMBER, 1851.

Thomas Crook, of Preston, Lancaster, cotton manufacturer, and James Mason, of Preston, warper, for certain improvements in looms for weaving. November 20.

Henry Richardson, of Aber Hirnant, Bala, North Wales, Esq., for certain improvements in life boats. November 20.

George Tate, of Bawtry, York, gentleman, for improvements in the construction of dwelling-houses and other buildings, including carriages and floating vessels, and in the propulsion of said vessels, and the adaptation and manufacture of materials for such uses. December 2.

Philip Nind, of Leceister-square, gentlema, for improvements in the manufacture of sugar, in distilling and in cutting and rasping vegetable substances. December 2.

George Fergusson Wilson, managing director of Price's Patent Candle Company, Vauxhall, David Wilson, of Handsworth, Esq., James Childs, of Putney, Esq., and John Jackson, of Vauxhall, gentleman, all of Surrey, for improvements in presses and matting, and in the process of and apparatus for treating fatty and oily matters, and in the manufacturing of candles and night lights. December 19.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Dec. 26	3067	James Black	Edinburgh	Paper-cutting machine.
27	3068	F. T. Jones and Co.	London	Moulding to be used as a picture-rod.
,,	3069	W. Peech	Sheffield	Non-equal shears.
29	3070	J. Chesterman	Sheffield	Double expanding and contracting spanner.
30	3071	Henry Kearsley	Ripon, Yorkshire	General tile-screening or grinding and brick-machine.
January, 1852.				
1	3072	George N. Haden	Trowbridge	Hand hard-labour machine.
,,	3073	J. Thornton and Sons	Birmingham	Railway-carriage roof-lamp.

CONTENTS OF THIS NUMBER.

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PROFESSOR PAGE'S ELECTRO-MAGNETIC ENGINE.

Fig. 2.

Fig. 3.

Fig. 1.

DESCRIPTION OF PROFESSOR PAGE'S ELECTRO-MAGNETIC ENGINE.*

(From a Lecture delivered by Professor Page in New York, reported in the *Scientific American*, November 15, 1851.)

When Professor Page took up the subject of applying electro-magnetism as a motive power, he found that all that had been done was based upon the attractive and repulsive properties of electro-magnets. An electro-magnet consists of an insulated wire, coiled round a bar of soft iron, with its ends open, and connected with a galvanic battery. When the circuit of the battery—the wire that connects the two last plates of it together—is closed, the end of the soft iron bar, which before was powerless, acquires a mysterious power, and will attract a mass of iron with great force to it. This will not produce a motive power—it is static force; but when the circuit of wire is broken, the virtue of the magnet ceases, and the attracted metal falls.

The first engine for producing motive power by electro-magnetism, invented by Professor Henry (now of the Smithsonian Institute, Philadelphia), in 1833, with a battery contained in one cubic foot of space, sustained a weight of more than 3,000 lbs.; and he constructed a machine to move machinery, which is described in vol. xx. of *Silliman's Journal*. The electro-magnet has two poles, the positive and negative, and the two similar poles of two magnets repel one another. Professor Page found that all the old electro-magnetic engines were constructed on the principles of attraction and repulsion, to produce motion. It is known that Davenport in America, Jacobi in Russia, and Davidson in Scotland, made, some years ago, electro-magnetic engines of considerable size; Jacobi propelled a boat on the Neva in 1839; Davenport and Ransom Cook had quite respectable engines working in New York in 1840; and Davidson ran a locomotive, in 1842, on a railway near the city of Glasgow.

The engine of Jacobi was about two horse power; that of Davidson propelled the locomotive, weighing 5 tons, at the rate of four miles per hour, and was equivalent to a little over one horse power; but Davidson used the attractive power alone, of the electro-magnet; as is represented in fig. 1.

The axle we will suppose to be one of the locomotives, with the wheels removed, and the magnets MM′ we will suppose to be firmly fixed on the truck of the engine. We will suppose the batteries to be fixed at each end of the truck, and now, if we had two axles and four wheels, we should have the locomotive; but fig. 1 will explain the principle of action much better. On the axle is a cylinder of wood, on which are secured three masses of iron at equal distances apart, and running the whole length. When one electro-magnet is charged it will attract one mass of metal to it, and thus make the axle move on its axis partly round; then this magnet has its circuit broken, and the opposite magnet charged, which attracts the opposite mass of iron on the cylinder, and thus rotary motion is given to the axle, and the wheels are revolved.

Near each end of the axle are two small cylinders, each one of which has the half of its rim next the large cylinder covered with metal; the outer halves *o o′*, are partly covered with metal and partly with ivory; the dark spaces on *o o′* represent the conducting parts of metal; the white are the ivory.

One end of the coil around magnet M′ is connected with Z, or pole of one battery, the other end of the wire *a* rests on *c*, the metal rim of one small cylinder. The wire *b*, from the other pole K, rests on the other metal part *o*, and thus the electric circuit is formed. The arrows point out the direction of the current, which, when the circuit is formed, renders the magnet M powerfully attractive, but when the circuit is broken, it has no attractive power. On the opposite small cylinder, the wire *e* rests on a non-conductor (the ivory), therefore the electricity cannot pass from *d* to *e*, the circuit therefore is broken, and while M is a magnet M′ is non-magnetic; but as the cylinder revolves, it will be noticed the ivory and the metal pieces on the small cylinders alternately break and close the circuits, and thus alternately attract the cylinder to give it a continuous rotary motion. Davidson used 78 pairs of 13 inch

* Patented in England, on Professor Page's account, by Mr. John J. Greenough.—See *Mech. Mag.*, preceding volume, p. 304.

plates, the negative being iron, the positive ones amalgamated zinc. The result of power was very frail for such an amount of battery surface. We have heard no more about Davidson since.

Professor Jacobi got out of twenty square feet of platina battery surface, one horse power. Many have believed, and now believe, that the principle of attraction and repulsion is better than the attraction alone. Davenport, of Vermont, used a walking beam engine with metal pistons moving in hollow magnetic coils, each coil forming a whole hollow cylinder.

Professor Page's engine differs from all these in principle, in arrangement, and action. He found that the magnet required time to receive the magnetism of the coil, or in the words of Snow Harris "to create a magnetic atmosphere," and it also required time when the circuit was broken, for the magnet to part with its induced magnetism; the induced magnetism, or secondary current of the magnet, acted also in the very opposite direction to the one required.

To remedy this, he came to the conclusion that it was necessary to make the current of the magnet (the secondary current) act always in the same direction with the object to be moved, at the same time it was necessary that the magnet should always be magnetic. This was for the purpose of gaining in the element of time, as the magnet could not at once be deprived of its counter-force. He therefore adopted the principle of *hollow electro-magnetic coils*, and a number of them, as represented in fig. 2. The principle by which this engine is operated is electro-magnetic attraction by the intermittent charging of a series of hollow magnets acting continuously on a piston magnet moving inside of them, in the direct line of motion, whether that line of motion be horizontal, vertical, or circular (rotary). Fig. 3 is a longitudinal vertical section of the circuit-changer, which performs the same office for this engine that a slide-valve does for a steam-engine.

The dark spaces are a series of hollow magnets formed of square copper wire wrapped round a mandril. There are about 1,500 yards of wire in each coil. These coils are covered with a non-conducting substance. When the mandril is withdrawn, and these coils fixed on a frame, they form a cylinder made up of sections (coils). They are all connected together metallically, but are so arranged and connected with the cut-off or slide, that but three magnets (hollow coils) are changed at once, and one coil is being continually cut off behind, and the current being continually thrown on to the coil before, in the direction in which the piston is moving. This is the peculiar feature of this engine; it is a continual electro-magnetic draught in the secondary current direction of the iron magnet; this magnet is a round mass of iron *a*, placed in the very centre of the coils. When the coils are charged, this bar of iron moves inside like Mahomet's fabled coffin, touching nothing. In the machine exhibited (on the lecture table) is a number of vertical coils, and inside of them a huge mass of iron of 520 lbs. weight; when these coils are charged by being connected to the battery, the huge bar mysteriously rises in the very centre of the coils; when the battery circuit is broken, the bar falls. A number of persons were placed on the platform on top of this bar, and they were elevated by that mysterious agency—which cleaves the oak tree into fragments, and no less powerful here, because unseen.

But let us describe the engine:—The dark spaces are the hollow coils, they are secured horizontally on a suitable frame. A is the piston or bar of iron, which is free to move in the inside of the coils, and which is attracted with great force, backwards and forwards in the inside of the hollow coils; *l* is a piston-rod secured to a double crank, which gives motion to a shaft, on which is a fly-wheel K. This shaft by having pulleys on it, can, by bands, give motion to all kinds of machinery. Attached to one side of the piston-rod is an arm *m*, which works the cut-off. The battery is not shown, but A is the positive wire, and B is the negative wire coming from the opposite ends of the battery. Thumb-screws are represented to screw the battery wire to the rods of copper, one running along one side the whole length of the coils, and the other close to the coils on a narrow platform of the engine frame; *d d* are small blocks which are connected with the hollow coils by the wires *g g*, and form the connecting points of the circuit, and perform a similar office to the ports of a steam-engine; *f* is the slide moved by the arm *m*. It has two thin strips of copper on it, separated a short distance at the

middle part. Each strip has two metal spring plates *e e* on it, always in contact with some of the copper blocks *d d*, as shown in fig. 3. Only two of these plates *e e* are in connection with the battery at once, the ones, for example, at the left hand for the motion of *a* to the left, and the other set for its motion to the right. The wires A′ B, the springs *h h*, the slides *e e*, and the wires *g g* form the electric circuit, rendering the coils magnetic; therefore, as the slides move backwards and forwards, the circuit is formed alternately from coil to coil, cutting off the current behind and throwing it on ahead, as spoken of before; *i* is the stroke-changer, that is, it reverses the stroke of the engine, by throwing the current from one half of the coils to the other half. This is done by two dogs, or projections *j j*, fixed on the side of the frame. The changer *i* is fixed on a centre-pin, and when it strikes one cam *j*, it brings one set of slides *e e* to form the circuit, and when it strikes the other cam *j*, the changer *i* turns on its pin, and comes in contact with the strip of copper which is attached to the other slides *e e;* there are, therefore, always three of the coils charged at once, as will be observed in fig. 3; but whenever a full stroke is made, the changer *i* at once diverts the current from one half of the coils to the other, acting upon the opposite end of A′, by the three coils near the middle being first charged, and so on one after the other as the piston moves along. A stroke of any length can thus be given to the engine—a thing never done before. The common electro-magnet—say one that will attract 1000 lbs. at one inch distant—will only attract 32 lbs. if placed at two inches distant; it loses power, to use a familiar phrase, according to the square of the distance. In this engine, the piston always moves in the magnetic equator, which is the centre of the hollow coils.

Figs. 4 and 5 represent a very ingenious electro-magnetic engine, invented by Soren Hjorth, of London, and patented April, 1849. The inventor proposed to apply it to propel ships and rail cars.

Fig. 5 is an elevation of the engine, and fig. 6 a section of the same. A A is a horse-shoe-formed hollow magnet, conical on the inside, coiled with copper or other wires, and suspended in such a way that it oscillates on the centre B, with suitable bearings and plummer-blocks, as shown in the figure. In the interior of this magnet are fixed a number of conical rods of different lengths. B B is another horse-shoe-formed magnet, conical on the outside, with apertures corresponding to the conical rods in the magnet A A, and likewise coiled with wire. This magnet moves on the guide rods D D, which are connected together at the top by means of the crosshead E, and fastened at the bottom of the magnet A A. The guide rods may also be fixed to the magnet C C, and guided by rollers. A connecting rod is attached to the magnet C C, in the centre, driving a fly-wheel shaft by cranks, in the usual way. F is the commutator to change the electric current as required, which is similar in its mode of working to the slide valve of a steam-engine, and moved in a similar way by an eccentric and eccentric rod. The action of the engine may be reversed by the use of a supplemental eccentric. The governor serves to regulate the proper supply of the electric current to the commutator O, as afterwards described.

The current, after being regulated by the governor, is introduced through the commutator into the helix of wires coiled round the magnet A A, and thence through the conducting wires to the helix or coil of wires surrounding the magnets C C, and thence through the conducting wires to the battery, or by the reverse course, as may be found convenient. As soon as the electric fluid from the batteries passes round the magnets, they exercise their power by a mutual attraction, not only in the ordinary way, but in consequence of the magnets being so shaped that the inside part of the outer magnet, as well as the outside part of the inner magnet, forms angles with the direction of motion of the moving or working magnet; and, at the same time, rods of different lengths presenting themselves at the poles of the respective magnets, the attractive power is sustained over the whole stroke by successive points and successive parts of the surfaces being brought to act upon one another during the whole stroke. When the stroke in this manner has been made by one set of magnets, the current is changed, and the other set of magnets are made effective by the current passing round them in the same manner as before described. In order to prevent the current from being broken, and also to check the momentum of the magnets, the slide in the commutator F is made so long that it does not leave the

conducting surface which communicates with one set of magnets until it has reached the other, communicating with the other set of magnets.

By the arrangements above described, a reciprocating motion is obtained similar to that of the common oscillating steam-engines, and it will be obvious that a motion may be obtained similar to that obtained by any of the various forms of steam engines by suitable adaptations of beams, rods, cranks, &c. Thus it may be carried out as a single or a double-acting engine, as an ordinary beam engine, or as a direct-action engine, according as it may be required for stationary, locomotive, or marine purposes; and in all cases its form may be varied according to the circumstances of the case.

The difference between Hjorth's—the most ingenious magnetic engine ever produced in Europe—and that of Professor Page, is very great. The piston *a* of Page's engine is a movable magnetized bar, and in every sense of the word is like the piston of a steam-engine, only there is no packing or cylinder covers required. The power of this engine, in proportion to the size of the battery, is very great; and it is asserted that, by increasing the battery, the power is increased in an equal, if not greater ratio.

The present is quite different from other magnetic engines, which are stated to have always produced results greatly disproportionate with large batteries. The free length of stroke which can be given to this engine, is a new and important feature, and the breaking and closing of the circuit at a distance from the magnetic pole or bar *a* is another important feature, for very feeble sparks and noise are thereby produced by the engine. There is a continuous series of flashes fleeting along, as the springs *ee* pass from one plate *d* to the other. It must not be forgotten that the changer *i* is continually in contact with the negative pole on the inside, and is only shifted mechanically on the positive side, to throw the current from one end of the piston to the other, to give the reverse stroke. No hot wells nor pumps are employed.

The question remains—Will this engine ever supersede the steam-engine? This engine, unlike others, we now say, is *practical*—positive evidence having been adduced to prove this; the question is one of economy between this and the steam-engine, which is also a very simple machine. We have not the means of judging of the comparative expense of this engine and the steam-engine, nor of comparing the practical working of the two; but it is well known what our opinion is with respect to the steam-engine; it is as yet the first of motors by a long way, and will yet be greatly improved. But a great stride in advance has been made by Professor Page; he has produced the most perfect electro-magnetic engine ever built, and future improvements, if they can be made (and who doubts it?), may yet bring it to be the compact motor so desirable for aërial navigation, and without which no such art can be rendered practicable.

THE PHILOSOPHY OF BOOK-KEEPING.

(Concluded from p. 6.)

Sir Henry Parnell (a member of the Committee on Finance, 1828,) had in his "Financial Reform" recommended a mode of book-keeping, which to Sir Samuel Bentham appeared uselessly complicated, and he prefaced his observations on it thus: "I am not an accountant by profession; I can have no predilection for Italian, English, or any other mode of book-keeping farther than as the one, more than the other, may be shown to afford the information required with the greatest clearness, and at the least expense of time or money. Clearness in the accounts relative to public expenditure seems the more necessary, as, in order that the public may derive full benefit from them, it is essential that they should be intelligible and instructive to a number of persons who are not expected to have acquired any accountant knowledge beyond that in use for their domestic concerns, but who, nevertheless, are intrusted with the management of those securities against inefficient expenditure; and for these reasons, I cannot but prefer that mode of book-keeping which has the fewest techni-

calities, if it be as good in other respects."

Sir Samuel's above allusions were to a considerable portion of the Members of the House of Commons, whose votes as a body decide annually on the grants of money to Government for national expenditure; but here again his observations are applicable to many of the holders of joint-stock property. He continues—

"In regard to the Italian mode of book-keeping, which you seem so decidedly to prefer, although not explained in your work, being desirous of satisfying myself that I had not mistaken its peculiarities, I have taken various means of inquiry, and have referred to several books on the subject; but on the present occasion, I shall select for reference the 'Encyclopædia Britannica,' as being a popular work likely to be in many hands."

In fact, he could hardly persuade himself that a mode practised by so very many of our most eminent merchants should be objectionable; and it was not till after having anew studied it in the counting-house of a distinguished banking and commercial firm that the following paragraphs were written:

"On reference to the article, 'Book-keeping,' I find that the distinguishing property of this mode is, that it is carried on by what is denominated *double entry*. To render clear what I have to say on this subject to persons not accountants, I may be excused making a few extracts from that work, showing the nature of this mode of book-keeping.

"The Italian method will be found to require 'three principal books.' 1st. A book denominated the 'Waste-book, or the Day-book;' 2ndly. 'The Journal;' and 3rdly. 'The Ledger.' The waste-book, or day-book (which latter name appearing to me the most appropriate term, I shall continue to use; *waste*-book being at the same time the most inappropriate for a book to be preserved as evidence), 'contains an exact register of all occurrences in business, in the same order as they take place.' The journal (like the day-book) is a fair record of all the transactions, but taken from the day-book, and entered 'in the same order as they stand there, but expressed in a *technical style*.' In the ledger the *arrangement* is different, 'articles of the same kind are collected together, and for that purpose it is divided into many accounts, under which the different branches of business are arranged. Each account is introduced by a proper title, to explain the nature of the articles it contains;' and 'on the opposite pages of the same sheet are placed money received on the one hand, and money paid on the other; or goods bought or received on the one side, and goods sold (or otherwise disposed of) on the other.'

"Thus, it appears, that the Italian mode of book-keeping has acquired its appropriate term of *double entry*, because, according to it, *two* entries of the *same facts*, in the *same* order, are made in *two books*, one called the day-book, the other the journal; in the one (the day-book) the entry is made in terms of ordinary language, being such as are the easiest set down and understood; but in the other book (the journal) the same facts are again entered in the same order, but translated into a *technical* language, well known to be wholly unintelligible to many, and little understood by any but the few who make it the object of their special study—a language the more objectionable as the terms employed being in common use for expressing other ideas, require, on this occasion, their signification to be changed before they can be made to render the facts intelligible.

"It has been supposed by many that the system of double entry did not depend on the peculiarity I have described, but on the arrangement of items from the day-book in another book (the ledger), putting all sums and articles received on one side of the book, and all those expended on the other side; but this arrangement will be found equally to take place in the ledger when books are kept by single entry.

"To give a better idea of the two languages used, here follow examples taken from the 'Encyclopædia Britannica,' in exemplification of double entry.

"According to the terms used in the day-book, an entry appears in it, 'Paid John Bull, in full, 52*l*.' A record of the transaction which, it appears to me, is expressed in as few words as possible, and in the most familiar terms; intelligible, I will venture to say, to every boy who might be employed to record the

transaction, and equally so to every one who might afterwards have occasion to look to it for information.

"The same transaction is entered in the journal thus translated, 'John Bull, Dr. to Cash, paid him in full, 52*l*.' Here are, in the first place, *nine* words employed to express what was in the day-book expressed in *five*. 2nd. A fictitious personage is created under the name of cash; a fiction which the uninitiated in the mysteries of double entry would not deem essential to perspicuity; and after having enlisted this fictitious personage into the service, it would not easily be comprehended by the uninitiated whether Bull had paid the sum to Cash, or whether Cash had paid it to Bull. Such a book as this journal I therefore look upon as worse than useless; in many important lights as mischievous;—mischievous on account of the extra time employed in writing such a journal; much more mischievous on account of the need required by it of engaging clerks possessing peculiar talents, instead of the ordinary ones of reading, writing, and casting accounts correctly, which extraordinary talents must be much more highly paid for;—and still more mischievous by reason of its unaptness for the object of accounts, that of affording intelligible information. What originally could have induced mercantile men to give themselves this extra trouble of learning and making themselves familiar with this mode of book-keeping, and of writing every transaction in the journal, does not appear; but what presents itself as the most natural and probable, is that of a wish for concealment of their transactions—a natural object in private transactions; but in regard to public concerns, no such motive seems justifiable; a great mischief must necessarily be the result if the technicality and source of obscurity introduced in the journal by the Italian mode were transferred throughout into all the accounts in which officers, ministers, and Parliament are to refer, for whatever information they may require relative to the management of public concerns.

"There is, however, one defect in accounts as kept by single entry, although it be not inherent in the principle itself; namely, that entries of all kinds are usually made in one ledger, at most under two heads; the one called the personal account, containing all accounts with persons, goods, and money —the other, the cash account, containing no transactions but such as relate to cash. Thus no separate account is kept as to any particular article of profit and loss, or of receipt and disposal. The ledger, on the principle of single entry, is, however, quite as susceptible of arrangement, by which articles of the same kind are collected together, and balances of them struck, as in the ledger where accounts are kept by double entry. By a column of reference, as used by Messrs. Brookman and Betts, reference may be made backwards and forwards from the day-book to the ledger, and *vice versâ*, the same as where a double entry had been made by previously transferring the items from the day-book to the journal.

"It is this more perfect ledger that I have in view when speaking of single entry, and I conceive it to be divided into as many books, and under as many heads, as the nature of the transactions to be kept account of, may for their elucidation require; as also that the entries are made in it by a book-keeper, *not* the same as that one who made the entries in the day-books, so that every item of account being entered by two different persons in two different books, a great advantage is obtained in point of correctness.

"To me it appears, that according to the description given above, and the same whether by double or single entry, the day-book and the ledger are the two forms of books requisite, and the only two, into however many different heads the ledger may be divided, or however many copies of them may be required for use in different places.

"The day-book being that in which facts are recorded as they arise, in language the most simple, and without any need of thought or abstraction of mind with a view to ulterior classification, is the least subject to error, and the writing is an operation that can be performed by any man or boy of ordinary understanding who can hear well, read what is before him, copy exactly, and write a fair hand. The purpose of the ledger, as appears from the above description, is the classing and exhibiting the facts already recorded under such heads as shall exhibit transactions of a similar

kind in a similar form, either as regarding money or money's worth. The facts or transactions are arranged in it under two leading divisions, one exhibiting the receipt of property, the other the disposal of it. In these two books, or sets of books, everything therefore is to be found that is required in accounts; recordation in the day-books, classification in the ledger.

"For the same reason that it appears to me better that the technical terms in the instances above adduced should be avoided, so should all other technical terms whenever terms in common use for the same idea can be employed. Instead of *debtor* and *creditor*, the terms that present themselves as being in common use, and as being better suited to public" (and to private) "accounts, which have for their subjects goods as well as money, are the terms *received* and *disposed of* * * *

"All such entries as 'Sundries debtor to Paper,' would thus be done away with as producing obscurity; although the term sundries, being a common and comprehensive term, might, perhaps, sometimes be employed in making abstracts to save the trouble of enumerating small items. And as to services, the simple facts of what services, by whom performed, at what time begun, when completed, at what rate, and when paid for;* so as to the material, of what nature, at what price, when received, what quantity, from whom, when paid for, how disposed of, would be intelligible to all, and ready for any use requisite to be made of accounts.

"In a large establishment where the transactions are extensive, some division might with advantage be made in the accounts—even from the first entry in the day-books. Of this description are, for example, in a naval arsenal, such articles as timber, iron, copper, or the wages or salaries of the personnel; each of which items might have its separate day-book; and so much the more conveniently, as one or two of these items would usually furnish ample employment for a clerk. So in that branch of the accountant-office, where cash payments might be made, there might possibly be a day-book for ready-money payments, another for bills drawn at future dates, and another for sums advanced in account. Every day-book should have a column for reference to the ledger, into which the several items would afterwards be posted, as that ledger would again have columns for reference to the day-books.

"The not *balancing* accounts with *sufficient frequency* appears to me to be a defect in book-keeping common to almost all methods, and to the very general practice; and it would seem that the more complicated the accounts the less frequently are balances struck, although in such cases frequency is most required. This defect may probably have originated in the uninterrupted use made of the day-book, so as not to leave time to the clerk, who keeps it, to make entries from it in the ledger, nor to admit of its being put into the hands of another to perform this operation until the day-book is filled up, and a new one taken. It appears to me that this difficulty might be obviated, either by having separate clerks to post the day-book daily, after the transactions of the day are over, or before those of the succeeding day begun—or by keeping two distinct day-books for alternate days, weeks, or months, as the case might require * * * The same object might be effected by the adoption of the practice sometimes resorted to of making the original entries on loose sheets, afterwards pasted, or otherwise attached together in a book; but this mode appears highly objectionable, not only on account of the real danger of loss of

* Accounts were so kept of work done in the three establishments above-mentioned, although no regular clerk was employed in any one of them; the items were entered, under the several heads enumerated above, in columns appropriately ruled, copies of these accounts were made by a Boulton and Watt's copying press, which were sent weekly for Sir Samuel's examination and sanction previously to payment of the operatives. One very remarkable instance of great earnings consequent on extraordinary skill seems worth mentioning here. The wages of a founder in the metal-mills amounted, on one occasion, to two or three-and-twenty-shillings a-day, he working by the piece at rates of payment *less* than were allowed by Mr. Jellicoe, a great private manufacturer at Gosport; Sir Samuel Bentham instituted a full inquiry on the subject, and found that the metal-mill operative had happened that week to have been employed on very difficult brass castings, that he was expert enough to rarely fail of success, though ordinarily, in other hands, several imperfect castings had to be rejected for every one that was accepted. Sir Samuel of course sanctioned payment of the full sum set down, and had the satisfaction to feel that Government were *gainers* by its great amount so arising, for much fuel was saved, as also that loss of metal always consequent on a re-melting of imperfect castings.

the loose document, or substitution of a false one, but also as constantly leaving room for suspicion of falsification.

"The accuracy of the most abstracted account (as, for instance, those which are laid before Parliament) must depend on the correctness of every item in all the accounts from which they are taken, in every degree down to the last minutiæ that are taken account of." And so it is in private accounts. "It is with these minutiæ, then, that the reform of books should begin, rising step by step to more condensed and more abstracted books, until ending, instead of beginning, with those laid before the superior authority * * *."

"The general idea that simplicity and perspicuity in recordation and abstraction are the objects to be aimed at in book-keeping, should be constantly pursued in the case of every account. In each case when it is to be considered how far the account answers the purposes intended, or what reform is needed in the mode in which it is kept, the first questions to be put are, What is the object of that particular account? What are the results it is intended to exhibit? The answers to these questions will readily point out under what heads, and in what particular form the items should be entered so as to exhibit those results in the simplest and most intelligible manner."

Mechanics are well aware that most of the improvements in machinery have arisen from its simplification; it is simplification of accounts which is aimed at in the above extracts. Doubtless, in many great manufacturing establishments, accounts are kept with both accuracy and simplicity, though perhaps but in few with the greatest possible degree of these desirable qualities; in lesser concerns, however, the usual routine of book-keeping as taught in schools is too frequently adopted—often to the detriment of proprietors, both by incurring needless expense in clerks' salaries, and in deficiency of perspicuity in the accounts they keep.

One not unfrequent cause of pecuniary failure in manufacturing concerns is a neglect of taking into account the *indirect* expenses attendant on them, but all of which are as essential to ultimate profit as the immediate outgoings for materials and workmanship. Sir Samuel, in the Portsmouth establishments, brought to account indirect as well as direct expenses, his statements of the outgoings and incomings of the metal-mills were severely scrutinised by a private manufacturer of copper sheathing, who was professedly endeavouring to obtain the abolition of these mills; but, after investigation of those accounts, he made no farther inquiries into the business, whence it was justly inferred that "there were not any defects which the scrutiny even of so interested a person could detect." The accounts of the Wood-mills, when exhibited in detail to the Navy Board, were made under the same heads; those heads are here subjoined as indicating, at least to young beginners in business, the various expenses essentially requisite to be brought into account. Should omissions in this statement of heads occur to any reader of the *Mechanics' Magazine*, it may be hoped they would be pointed out in some future Number of it.

The heads of accounts kept in the Wood-mills, furnished to the Navy Board by Sir Samuel Bentham, were as follows:—

"*Outgoings.*

"1. Account of outstanding capital, carried on from half-year to half-year as it was expended.

"2. Interest on ditto, at 5 per cent. per annum

"3. Estimated expense, at the rate of hazardous insurance, from loss by fire.

"4. Capital sunk in buildings and machinery.

"5. Extra per centage, at the rate of 5 per cent. per annum, on this particular capital, as requisite in form of rent beyond interest on the money sunk.

"6. Estimated expense in the way of rent, during the first three years and a half, for the occasional use of the steam-engine, employed principally for pumping docks.

"7. Current expense of keeping the steam-engine at work, including engine-keeper's wages.

"8. Cost of various small articles of tools, &c.

"9. Salary to the master of the Wood-mills.

"10. Estimated expense; namely, at the rate of 25*l.* per annum, for this

concern, of calculating and preparing in my office, by my first clerk, the weekly accounts, such as of wages due to the several persons employed in these mills.

"11. Estimated expense of advertising (by the Navy Board) for materials, &c.

"12. Wages to wood-millers, blacksmiths, labourers, &c.

"13. Materials and other articles received from the dockyard stores, including an extra sum put upon their cost price to pay the Dockyard expenses, &c., on the receipt and subsequent delivery to the mills.

"14. Estimated expense of sending blocks and block-makers' wares to other dockyards.

"*Per Contrà Returns.*

"1. Value of articles manufactured in these mills and delivered into store at Portsmouth Dockyard, reckoned at the prices then paid to contractors, as influenced by the proportions received from different ones, who were respectively paid for the same articles at a higher and a lower rate.

"2. Value of the customary extra workmanship on ditto.

"3. Value of offal sold or returned into store.

"4. Value of stock in hand."

M. S. B.

MR. BABBAGE ON THE GREAT EXHIBITION.*

The future historian of mathematical science in this country, during the present century, will confer a lasting benefit on his countrymen, if he carefully ascertains the exact position of that science at the commencement of the period mentioned, examines what progress has been made in each department up to his own epoch, and then impartially awards to each cultivator the credit which is justly due to him for his contribution to the general stock.

We, some time ago†, made an attempt in this way to do justice to the labours of the Herschels. Our sketch was necessarily imperfect; but although we failed to accomplish all we wished, we are inclined to think that we succeeded in showing that the friendly and generous patronage of George the Third to Sir William Herschel, had been abundantly repaid by the magnificent achievments of the father and son,—that the royal patron of Herschel, as a reward for his friendly munificence, had had his name indissolubly connected with the stars, and his memory written in sunbeams in the imperishable annals of science. We trust that some writer hereafter, possessed of more ample means for the due performance of the task than we could command, and altogether better qualified to do justice to the subject, will take the matter up, and more completely illustrate our position—that George the Third's royal patronage brought celebrity of the highest order on his country, and conferred lasting benefits on every other country where science is cultivated. Such an exposition, if truthfully drawn, may induce some of our modern patrons of sketchers and dancers, to consider the claims of the labourers in science, and to learn that the country's success and greatness depend chiefly on the scientific acquirements and mental energies of the people, and not at all upon frivolous gewgaws or fantastic fopperies, whether British or foreign.

However, when mathematical science shall find such an historian as we have pointed out, men whose labours have hitherto been slighted, or decried, will have justice done them. For instance, Mr. Babbage will stand among the foremost of the select few who led the way in the redemption of the mathematical sciences in this country.

"*When it was in vain to conceal the melancholy truth that we were fast dropping behind,—when in mathematics we had long since drawn the rein, and given over a hopeless race,*"—it will indisputably appear that Mr. Babbage was one of the noble chiefs who first came to the rescue of mathematical science, when in its utterly for-

* "The Exposition of 1851; or, Views of the Industry, the Science, and the Government of England. By Charles Babbage, Esq., Corresponding Member of Moral Sciences of the Institute of France. Second Edition, with Additions. London: John Murray."

† See Review of "Herschel's Astronomy," No. 1367.

lorn state in England. The principal initiatory step that was taken towards renovating that science in this country, in our opinion, was the translation of "Lacroix's Differential and Integral Calculus," which led to the general adoption of that notation instead of the fluxional. But this was not all; in no long time it brought Englishmen acquainted with the various subjects to which our continental neighbours had applied that part of science. By-and-by new life seemed to have been breathed into our torpid science, which imparted an impulse to it that has since carried it to that proud position which it at present occupies. Now to whom are we indebted for laying the foundation of that position?—Undoubtedly, in a great measure, to Mr. Babbage. He, Sir John Herschel, and Dr. Peacock (the present Dean of Ely), jointly translated Lacroix, and to them jointly belongs the merit and the national gratitude which is so justly their due for letting in this new light upon English mathematics, and inspiring it with such a source of health and vigour. For this meritorious aid, rendered at such a juncture, we think Mr. Babbage is entitled to the high esteem of every Englishman who has a particle of regard for the scientific celebrity of his country. But this preliminary work was done upwards of thirty years ago, and an uninformed reader may naturally ask—What has Mr. Babbage, since that rather distant period, done to assist in the progress of science? We can answer, with the utmost confidence, that few have laboured more energetically or more successfully than he has done, down to the present hour. At the end of the work now before us, there is a list of Mr. Babbage's contributions to science on a great variety of subjects, amounting to *fifty-three*. We shall not enter upon a critical examination of the whole of these articles, but we may venture to remark that every one of them bears the impress of a master-mind, and contains a valuable addition to the common stock of human knowledge. Very probably the list might have been extended: for example, we think that many mathematical questions and their solutions, in the fourth and fifth volume of the *Mathematical Repository*, were Mr. Babbage's, under the signature of "C. B." We observe the Prize Question (470) is very similar to one contained in his paper on some questions connected with games of chance, in the *Edinburgh Transactions*, and the notation is like that used by him in the *Cambridge Philosophical Transactions*, published about the same time. However, be this as it may, the British public is Mr. Babbage's debtor for many valuable works, about the authenticity of which there is no question. First, his essays towards the calculus of functions, printed in the *Philosophical Transactions* for 1815-1816. These articles formed a complete treatise on a subject which, to the greater number of English mathematicians, was then altogether new. A knowledge of this branch of analysis is absolutely necessary as a preparation for unravelling Laplace's celebrated coefficients. We think the important labours of Murphy, O'Brien, and others, will confirm the correctness of this view. Without this key, it was impossible to unlock the mysteries of Lagrange, or to become acquainted with the magnificent performances of the continental mathematicians. We therefore consider these essays, and their subsequent publication in Sir John Herschel's "Examples," as one of the most important steps that was taken to modernize and reanimate mathematical science in this country. Englishmen have vast reason to congratulate themselves on the progress that has since been made; but they should bear in remembrance the splendid labours of Mr. Babbage and his coadjutors, who first opened the way, and have since continued to be leaders in it.

Probably the mental exercise in the functional analysis, and in its application to different matters, first suggested the idea of performing the requisite calculations mechanically: hence, perhaps, the groundwork of Mr. Babbage's celebrated Difference Engine, or Calculating-machine. As the history of this engine is treated at considerable

length in the book before us, and forms the groundwork of some remarks we have to make on the treatment experienced by its inventor, we think a brief statement of the origin and performances of the machinery may be interesting to many of our readers, as well as apposite to the object we have in view.

Some years ago, the Government of France had Mathematical Tables of various kinds computed, under the direction of M. Prony: they occupied seventeen large folio volumes. Some members of the Board of Longitude in England perceived their value, and overtures were made to the Board of Longitude in France to print an abridgment of them, at the joint expense of both countries. The proposal was declined. The manual labour of calculating these tables had been immense. One table only—that of the logarithms of numbers—contained above eight millions of figures. But inasmuch as these tables follow a certain law well known to mathematicians, it occurred to Mr. Babbage that the greater part of the manual calculations might be effected by machinery. His Difference Engine was the result; which is stated to be capable of performing the labour of EIGHTY-EIGHT calculators; so that, if the English Board of Longitude had availed themselves of Mr. Babbage's machinery, they might have had the same tables calculated by means of twelve, or even a less number of calculators, instead of NINETY-SIX, which the French Board had employed. M. Prony's account of his proceedings with the immense undertaking, is given in Mr. Babbage's work on the "Economy of Machinery," Chap. 12. The reader should bear in mind that Mr. Babbage's invention was first set in motion on the subject, to accomplish a national object of surpassing difficulty, and of vast importance. But it may be asked, Was Mr. Babbage's machine an imaginary contrivance, appearing, perhaps, exceedingly satisfactory in his description, but would it bear the test of an examination by men qualified to form an opinion on its capability?—Is it a piece of novel machinery, the utility of which exists only in its contriver's imagination, or is it a reality that has undergone the *experimentum crucis* of actually calculating numbers in accordance with its pretensions?

In the first place, Mr. Babbage's machine was examined by a Committee composed of the principal scientific men in England, who reported on the 1st of May, 1823, that it appears "that Mr. Babbage has displayed great talents and ingenuity in the construction of his machine for computation, which the Committee think fully adequate to the attainment of the objects proposed by the inventor, and (that) they consider Mr. Babbage as highly deserving of public encouragement in his public undertaking."

Another Committee, similarly composed, in 1828, having minutely examined the drawings, tools, and the parts of the engine then executed, admitted its public utility, and the immense advantages of accurate numerical tables in all matters of calculation, which it is professedly the object of the engine to calculate and print with perfect accuracy, report that they have no hesitation in giving it as their opinion that the engine is likely to fulfil the expectations entertained of it by its inventor. The following is an account of the engine by the late Francis Baily, Esq., taken from Professor Schumacher's "Astronomische Nachrichten," No. 46: "The Board of Longitude employed Dr. Hutton to calculate square numbers as far as 25·400. In computing a Table of this kind by the machine, even if extended to the most remote point that could be desired, the whole of the mental labour would be saved; and when the numbers 1, 1, 2, are once placed in it, it will continue to produce all the square numbers in succession without interruption. This is, in fact, one of those Tables which the engine already made is capable of computing as far as its limited number of wheels will permit. In computing tables of cubes and higher powers, square roots, and cube roots; tables of the reciprocals of numbers; tables of natural sines, cosines, tangents, &c., he thinks the labour would be reduced to the 2000th part of the whole. In forming hy-

perbolic logs. 200th of the labour would be saved by the engine." These reports and accounts would appear to be satisfactory—but what has the engine actually done in addition to this? On p. 198 of the "Economy of Machinery," in a note, the author says, "Since the publication of the second edition of this work, one portion of the engine which I have been constructing for some years has been put together. It calculates in three columns a table with its first and second differences. Each column can be expressed as far as five figures, so that these fifteen figures constitute about one ninth part of the larger engine. The ease and precision with which it works, leave no room to doubt its success in the more extensive form. Besides tables of squares, cubes, and portions of logarithmic tables, it possesses the power of calculating certain series whose differences are not constant; and it has already tabulated parts of series formed from the following equations:

$\Delta^3 u_x$ = units figure of Δu_x. $\Delta^3 u_x$ = nearest whole number $\lambda\left(\frac{1}{10\cdot000}\Delta u_x\right)$

The subjoined is one amongst the series which it has calculated:

0	3,486	42,972
0	4,991	50,532
1	6,907	58,813
14	9,295	67,826
70	12,236	77,602
230	15,741	88,202
495	19,861	99,627
916	24,597	111,928
1,504	30,010	125,116
2,340	36,131	139,272

The general term of this is

$$u_x = \frac{x \,.\, x-1 \,.\, x-2}{1.\ 2.\ 3.} +$$

the whole number in $\frac{x}{10} + 10\Sigma^3$

units figure of $\left(\frac{x \,.\, x+1}{2}\right)$."

To persons unacquainted with mathematics, these performances, by an engine, are utterly incomprehensible, and, at first sight, even to mathematicians who are accustomed to make such calculations in the most expert and shortest manner, they appear almost incredible—it is only by deeply considering the nature of the work, and the subtle adaptation of machinery to accomplish it, that the feasibility of the matter becomes apparent. When, however, the engine had satisfied parties best qualified to form a judgment as to its capabilities, and had astonished the scientific world by its actual performances—it was almost unaccountably brought to a stand still; and though only paralyzed, according to Mr. Weld's History, it was suffered to be interred: he says, "In 1843, an application was made to the Government, by the Trustees of King's College, London, to allow the engine, as it existed, to be removed to the Museum of that Institution. The request was complied with; and the engine, inclosed within a glass case, now stands nearly in the centre of the museum. It is capable of calculating to five figures, and to two orders of differences, and performs the work with absolute precision."

It seems the Government vouchsafed to the engine its fostering protection, and after lingering under its blighting influence for many years, the singular invention became defunct — or was considered so by its patrons—and it was at length buried in a glass coffin. But undeterred by this disheartening treatment, even whilst the Difference Engine was lying in a torpid state, to which its foster patrons had brought it the inventor devised another engine of still more surpassing powers — he contrived another system of mechanism almost intellectual, the operations of which possess all the generality of algebraic notation, and which, on this account, he denominated the "Analytical Engine." Our space is too limited for any lengthened remarks on this invention; we can only indicate a few of its characteristics. The Difference Engine was constructed to tabulate the integral of the function

$$\Delta^7 u_x = 0,$$

or $u_x = a + bx + cx^2 + dx^3 + ex^4 + fx^5 + gx^6$; the constants a, b, c, &c., are represented

on the seven columns of discs which the engine comprises. Hence the engine can tabulate accurately and to an unlimited extent all series, the general term of which is comprised in the above formula. The engine can also tabulate approximately between intervals of greater or less extent all other series which are capable of tabulation by the method of differences.

But the Analytical Engine is not merely adapted for *tabulating* the results of one particular fraction, and of no other, but for developing and tabulating any indefinite function of any degree of generality or complexity, as

$$F(x, y, z, \log. x, \sin. y, x^{\mu}, \&c.,)$$

a function of all other functions.

The author says, p. 174, "As we advance towards machinery for more complicated objects, other demands arise, without satisfying which our further course is absolutely stopped. It becomes necessary to see at a glance, not only every *successive* movement of each amongst thousands of different parts, but also to scrutinise all contemporaneous actions. This gave rise to the mechanical notation—a language of signs, which, although invented for one subject, is of so comprehensive a nature as to be applicable to many. If the whole of the facts relating to a naval or military battle were known, the mechanical notation would assist the description of it quite as much as it would that of any complicated engine."

We consider this invention to be of high interest and importance; as an illustration of its utility, it should be mentioned, that it enabled M. Menabria, a distinguished Italian geometer, by means of a copy of the engravings of the Analytical Engine, to enter into the spirit of the great principles on which the invention rested, and to draw up an explicit and excellent memoir on the subject. This interesting memoir appeared in the *Bibliothèque Universelle de Genève* for October, 1842; it has since been translated, and published in the third volume of "Taylor's Scientific Memoirs," with copious and valuable notes by the Countess Lovelace (daughter of the celebrated Lord Byron.) In reading this celebrated memoir in its English dress, one finds it difficult which to admire most; the invention of the discoverer—who has invested machinery with powers nearly approaching to human intellect—the writer of the memoir, who, possessing such slight means for obtaining adequate comprehension of the engine, has so completely imbued himself with the true spirit of the invention as to place it before his readers in the clearest light—or the highly-gifted translator, whose appropriate notes prove her intimate acquaintance with the abstruse and complicated nature of the subject. Maria Gaetana Agnesi is celebrated wherever the mathematical sciences are cultivated: our own Mrs. Somerville has established for herself a celebrity which will live as long as the sublimest productions of the human mind exist: Lady Lovelace has given proof that she, too, belongs to the same illustrious class—the aristocracy of intellect—the genuine nobility of the creation:

"Ada, sole daughter of my house and heart,"

will confer another immortality on the author of the affecting line.

Lady Lovelace shows, in her illustrative notes, that the Analytical Engine may compute a variety of complicated formulæ. For instance,

(1) To multiply

$$A + A_1 \cos\theta + A_2 \cos 2\theta + A_3 \cos 3\theta + ..$$

by $B + B_1 \cos\theta$,

showing how the coefficients and other results would appear.

(2) How a series may be divided by a series, as

$$\frac{a + bx + cx^2 + \ldots.}{a_1 + b_1 x + c_1 x^2 + \ldots.}$$

(3) How integrals of the form

$$\int \frac{x^n\, dx}{\sqrt{a^2 - x^2}}$$

can be operated upon.

(4) How the engine may be employed in computing the numbers of Bernoulli, illustrated by a diagram, which must be exa-

mined to be understood and duly appreciated.

The inventor states, "that the attendant shall stop the machine in the middle of its work whenever he chooses, and as often as he pleases. At each stoppage he shall examine all the figure wheels, and if he can, without breaking the machine, move any of them to other figures, he shall be at liberty to do so. Thus he may, from time to time, falsify as many numbers as he pleases; yet, notwithstanding this, the final calculation, and all the intermediate steps, shall be entirely free from error. I have," adds the discoverer, "succeeded in fulfilling this condition by means of a principle in itself very simple." From what we have said on these engines, we think the reader can form his own judgment as to their invention and capabilities. If he knows any production of genius in the whole history of the human mind that can be compared to them, he is acquainted with a fact which has not been made known to us.

We have thus endeavoured to give a sketch of Mr. Babbage's labours in the cause of British science and philosophy. The outline, imperfect as it is, would, we think, be still more incomplete if we did not add to it some account of the *return* that the nation for which Mr. Babbage has done so much, has made to him.

(*To be continued in our next.*)

PATENTS OF APPLICATION.

Court of Queen's Bench, Westminster, 5th December, 1851.

SCI. FA.—QUEEN *v.* STEINER.

[An action at common law had been previously brought by Steiner for an infringement of the patent now sought to be repealed, when the Jury, under the able direction of Lord Chief Baron Pollock, found a verdict against the patentee. We quote from Mr. Lund's Treatise the following notice of the former trial:

The application simply of what is old to a new purpose, or the new use of an old art, is not patentable.

In Steiner *v.* Heald (2 Car. and K. 1022), the invention patented was for extracting from spent madder a certain colouring matter used in dyeing, and known by the name of *garancine*. It appeared in evidence, that *garancine* had been made from *fresh* madder, by means of sulphuric acid and heat, before the date of Steiner's Patent; and that the process for making *garancine* from *fresh* madder and *spent* madder are the same. It was also in evidence, that fresh madder contains a portion of free colouring matter, which may be extracted from it by merely boiling it in water; and that it also contains a further and considerable quantity of colouring matter, which cannot be obtained by such boiling. That this further quantity of colouring matter resides chiefly in the vegetable fibre of the root, and in very small quantities in the lime, magnesia, &c., which the root contains; but by submitting the madder to the action of an acid, the residue of the colouring matter can be set *free*, so as to be capable of being extracted by boiling water. And Pollock, C.B., said: "It is nothing but a patent for a process perfectly well known, and which is available with fresh madder to get a great deal more madderine (*garancine*), than you can get in any other way. It is applying the same process to madder that has been used; and the moment that the witness stated that, *mutatis mutandis*, it is merely applying Papin's Digester to bones which have been merely boiled, it struck me there was an end of the matter." And again, ... "He (the witness) says, this invention is neither more nor less than this:

"Supposing a person had got a patent for using Papin's Digester, to get all the gelatine that can be abstracted from fresh bones; somebody finds, that the bones which have been merely subjected to the common process of boiling have a great deal of gelatine in them, and he says, 'I will apply Papin's Digester to these bones, and I will get the balance of gelatine that is left by the common imperfect process.' That was the description of the witnesses, which seems to me to bring the question to the clearest point of fact that can very well be presented. Crane *v.* Price is distinguishable from this, by there really being some difference: here there is none.

"A person discovers a process by which he can get from fresh madder a large quantity of an article which I must now take to be well known, called garancine. Somebody applies precisely that same process to madder that has been merely boiled. There is no magic in a name, or in any language that could be used. The boiling of madder gets out only some of it. This process gets out

the rest of it. And in my opinion, in point of law, if the matter is reduced to that, you cannot take out a patent for using a perfectly known process, to get the residue of an article from a material which is known to furnish it, the process being one by which you could get in the first instance more, or the whole of the article, and by your use of the process you merely get the residue which the common process left behind. I think all the instances that I have alluded to apply distinctly to this. The case that was put last night, and which was adopted by the witness in giving his answer, clearly applies to it. If it was discovered that bones in a certain state, found in old caves, had some gelatine left in them, I do not think you could take out a patent for getting gelatine out of them by using Papin's Digester. If you adopt some new process, then you may do it. In the article of tea this is precisely the same thing. It might be possible to make that argument, to some extent, not so grave and dignified as the one that is immediately before us; but I am clearly of opinion, that if there were an article made from fresh tea, a person could not take out a patent for using precisely the same process to tea leaves that had been subject to the common infusion, and only given out a portion of their virtue. So, with respect to coffee, if there were a process of getting caffeine. And if the same process precisely be applied to coffee grounds, for the purpose of getting the residue of the caffeine, I do not think a patent could be taken out for that. There is no magic in calling this spent madder: it is madder that has undergone a process by which its whole virtues are not extracted. It appears to me, that that is precisely the same as if you applied a process to grapes already imperfectly squeezed, by which you squeezed a little more juice out of them than was formerly done. I do not think you could have a patent for that, for see what it would lead to; if a person in manufacturing districts, where they extract metal from certain ores, were to find that by applying a process to an ore, you could get ten per cent. more of the metal, and it then became worth working the refuse that might stand around in heaps — covering many acres, possibly—it would be just worth while to work that over again by the new process. I am clearly of opinion, that no stranger could step in and say, 'Now, I will have a patent for using your process, which you have given to the public. I will have a patent for using it to this old rubbish, because it may yield some ore.' I do not think that would do. It appears to me, that so far from the public benefit being consulted by that, the argument tends precisely the other way. It seems to me, therefore, that these facts being before me, and being ascertained to be such as I have stated, I ought to direct the jury, in point of law, upon the fifth plea, that the said alleged invention was not, and is not, any manner of manufacture for which letters patent could lawfully be granted, according to the true intent and meaning of the statute in such case made and provided."]

SIR FRED. THESIGER, for the Crown (with whom was Mr. Hindmarch and Mr. Cleasby), stated that this was a proceeding, by *scire facias*, to repeal a patent, granted on the 8th of August, 1843, to Frederick Steiner, for "a new manufacture of a certain colouring matter, commonly called garancine," being a communication from abroad. The colouring matter termed garancine is extracted from the root of the madder plant, and is extensively used in dyeing various kinds of manufactures. For a long time, the colouring matter was extracted by the means of hot water, the refuse, termed "spent madder," being considered useless. It was believed, however, that the spent madder contained a considerable quantity of colouring matter in combination with the woody fibre of the root, and various plans were, from time to time, suggested for extracting this matter, and turning it to a useful purpose. The defendant, Steiner, a native of Alsace, a place celebrated for the culture of the madder plant, obtained a patent for this object on the 2nd of June, 1832. According to the specification of that patent, diluted sulphuric acid, of the strength of 1·020, was to be employed. That method was, by the specification, stated to be applicable to the extraction of the colouring matter from both fresh and "spent madder;" but it did not appear that so weak a solution of sulphuric acid had much effect in extracting the colouring matter from "spent madder." The defendant, subsequently, in August, 1843, took out the patent now in question, which was specially applicable to the extraction of colouring matter from "spent madder." According to the specification of this patent, a much stronger solution of sulphuric acid was employed; and the operation of this solution being further assisted by the addition of artificial heat, it was found that a large portion of colouring matter, held in combination with the fibre of the wood, could be obtained. It appeared that Messrs. Heald and Wilson, of Manchester, had for some time held a license from the defendant for the use of his invention; but, conceiving that the invention was substantially included

in the defendant's patent of 1832, they refused to continue to work under such license after the expiration of that patent in 1846. On behalf of the Crown, it was contended that the patents of 1832 and 1843 were substantially the same; for, by using a stronger solution of sulphuric acid than was indicated by the specification of the first patent, the heat, which was considered as constituting the improvement in the second patent, was obtained—the combination of sulphuric acid, in a large proportion with water, producing a high degree of heat. Upon this ground it was contended that the defendant, in claiming the application of heat as a novelty, had claimed what was not new. Another objection taken to the defendant's patent of 1843 was, that the method there described was identical with that of the French chemists, Gaultier and Person, as explained in a work published in the French language in the year 1834, entitled "Manuel du Fabricans d'Indiennes." This work was published nine years before the defendant's patent was taken out, and was proved to have been sold to many parties in England, and particularly at Manchester in the year 1834, and following years. It was also proved by a Mr. Peake, a manufacturing chemist, that before the year 1843 he had actually manufactured a ton of garancine from "spent madder," according to the instructions contained in the "Manuel."

In support of the patent, several scientific witnesses of eminence were called, who gave their opinion that garancine could not be made in the mode pointed out by the "Manuel;" but, on cross-examination, it was ascertained that those witnesses who spoke so positively upon this point had never made the attempt, though some of them had been experimenting upon madder for several months. It also appeared, from the evidence given by defendant's witnesses, that the work in question was but little understood or appreciated by the parties most interested in its contents.

Lord Campbell, in summing up the evidence to the jury, said, the question for their determination was, whether the invention, at the date of the patent in 1843, was a novelty in this country. The defendant did not profess to be himself the inventor of the improvement, but to have received information of the discovery from a foreigner. If, however, he took out a patent for the invention before it had become known and practised in England, the patent was good in law; though, if it had become already known and practised, the patent should be repealed as void. The first question the jury would have to determine would be, whether the improvement claimed by the patent of 1843 was substantially claimed by that of 1832; but as they would probably be of opinion that it was not, the main question would be, whether the mode of applying sulphuric acid along with steam, as recommended by Gaultier and Person, was not perfectly well-known in England by the publication of the "Manuel" for several years before the defendant took out his patent. His Lordship here called the attention of the jury to the evidence upon this point, and observed, how satisfactory it would have been if those scientific witnesses, who had spoken to the impossibility of making garancine in the mode pointed out in the "Manuel," had made the attempt. If the attempt had been made, it would have been very satisfactory to the jury to have been informed of the result of the experiment; but, as that experiment had not been made, it naturally led to the inference that they had abstained from making the experiment because they thought it would have answered too well. The jury would, however, judge between the parties, and say whether, upon the whole, they thought the defendant's intention was substantially the same as that described in the "Manuel," and whether they believed that the latter had become known and practised in this country before the year 1843.

The jury retired to consider their verdict, and, upon their return into Court, gave it in favour of the Crown.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING JANUARY 5, 1852.

Charles Payne, of Wandsworth-road, gentleman. *For improvements in drying animal and vegetable substances, and in heating and cooling liquids.* Patent dated July 3, 1851.

The "improvements in drying animal and vegetable substances" consist in employing for that purpose a combination of exhausting apparatus for producing currents of air with thermometric apparatus for regulating the temperature of the air according to the nature of the substances operated on.

The "improvements in heating and cooling liquids" consist in employing apparatus for exhausting in combination with suitable means for producing currents of heated or cold air, according as the liquids are to be heated or cooled.

Claims.—1. The improvements in drying animal and vegetable substances.

2. The improvements in heating and cooling liquids.

Charles Cowper, of Southampton-buildings. *For improvements in the preparation of cotton for dyeing.* Patent dated July 3, 1851.

These improvements consist in preparing cotton for dyeing and bleaching, by subjecting it in closed vessels to the action of water or of chemical solutions, caused to traverse the same under a pressure greater than that of the atmosphere, the object being to expel the air contained in the fibres of the cotton, and likewise to remove dirt, in order to render the cotton capable of undergoing subsequent operations with advantage.

Claims.—The preparation of cotton for dyeing and bleaching, by placing the same in a close vessel, and forcing through it water, or a solution of a mordant or other solution, the passage of which is prevented and regulated by a loaded valve or other equivalent contrivance for securing within the vessel a pressure greater than that of the atmosphere.

James Howard, of the Britannia Ironworks, Bedford, agricultural implement maker. *For improvements in ploughs, and other implements or machines used in the cultivation of the soil.* Patent dated July 3, 1851.

The implements described and claimed under this patent are as follows :—

1. A method of attaching the share of ploughs to the lever which carries it, so as to admit of the share being adjusted to any required angle, and the use for this purpose of a screwed rod for tightening the lever neck lengthwise, together with the supporting of the lever neck by a fixed fulcrum pin, and the placing of the fulcrum in the forward part of the frame.

2. An improved construction of coulter, made from oval or elliptical bars of iron instead of the circular ones hitherto employed.

3. An improved subsoil plough, having a frame composed of two bars of iron, braced firmly together, and two wheels to run in the same track on the land side, together with a third wheel to run in the furrow.

4. An improved manufacture of cast iron wheel for agricultural implements, having a hollow central conical boss closed at one end, and provided with lips or flanges at the other end, to enable the plate by which the wheel is secured to the axle to be bolted thereto, after the manner of what are known as "patent axle boxes."

5. A method described in which a chain, hooks, and a tightening screw are employed, as also any analogous means of giving to the hinged bars of harrows temporary rigidity.

Richard Jex Crickmer and Frederick William Crickmer, of Page's-walk, Bermondsey, engineers. *For improvements in packing stuffing-boxes and pistons.* Patent dated July 3, 1851.

The improved packing which forms the subject of this patent is composed of a combination of metal in the form of wire cloth, or thin perforated sheets, with flexible and elastic materials.

In packing stuffing-boxes, two or more rings of wire cloth are employed to encircle the piston-rod, or other rod working in the stuffing-box, then two or three rings of prepared canvas, then a ring of vulcanised india-rubber, two or more rings of prepared canvas, and the whole enclosed by a band of metal. The india-rubber ring being expanded slightly when put in its place, has, of course, a tendency to contract, which preserves a tight joint, and prevents the escape of steam or water through the stuffing-box.

In packing pistons a ring of perforated sheet metal is employed, which comes in contact with the interior of the cylinder. In this case the india-rubber ring is compressed between the other rings of packing, and, by expanding, keeps the packing in constant close contact with the interior of the cylinder.

The patentees prepare canvas for the above use by saturating it with a mixture composed of sixteen parts of fat or grease, to which, while in a melted state, there has been added three parts of black lead, two of sulphur, and one of alum.

Claim.—The method described of packing stuffing-boxes and pistons, by combining metal with flexible and elastic materials.

George Kemp, of Carnarvon, doctor of medicine. *For a new method of obtaining power by means of electro-magnetism.* Patent dated July 3, 1851.

Dr. Kemp's improvements consist in causing a series of electro-magnets to act successively through their armatures on the same bar or instrument, and thereby to communicate motion to pistons and fluids, so as to produce motive power. The armatures are attached to the bar by stems, which are free to slide in the bar, and are placed at gradually increasing distances each from its respective electro-magnet. Thus, supposing the first armature to be a a quarter of an inch distant from its electro-magnet, the second will be half an inch distant, the third three-quarters of an inch, and so on. The object of this arrangement

is to bring the armatures successively within the range of the magnets, so that when the first electro-magnets has exerted its moving power on the first armature, the second armature will be in a position to be acted on by its electro-magnet; and when that armature has been acted on, the third armature, having been gradually advanced during this time, may have arrived at a suitable position to be acted on by the third electro-magnet, and so on. In order to apply the power thus obtained, two of such bars are to be connected directly, one to each end of the rod of a piston working in a cylinder, and giving motion to water or other fluid therein. The piston of this cylinder is connected to a second piston working in another cylinder of smaller diameter than the first one, in order to produce a more rapid motion than could be obtained from the piston in the first cylinder, and the motion is communicated from the piston of the second cylinder by a crank, or any other convenient means. The arrangements described are those which the patentee prefers, but others may be employed if thought proper.

Claim.—The method described of obtaining motive power, by causing a series of electro-magnets to act successively on the same bar or instrument, and thereby to give motion to pistons and fluids.

JOHN ASTON, of Birmingham, manufacturer. *For improvements in buttons and ornaments for dress, and the machinery for making the same respectively.* Patent dated July 3, 1851.

These improvements have relation to the manufacture of die and pressure-made covered buttons, and consist—

1. In constructing the moulds or forms for such buttons from the solid wood, (for which purpose the patentee employs by preference sycamore, though other woods, such as maple or birch previously well dried, may be substituted) instead of making them as heretofore of sheet metal; and

2. In certain arrangements of apparatus for the purposes of cutting out or forming such moulds or forms, and of putting together buttons when such moulds or forms are employed.

ROBERT HAYES EASUM, of Commercial-road, Stepney, rope-maker. *For improvements in the manufacture of rope.* Patent dated July 3, 1851.

Claim.—A mode of manufacturing rope by twisting an assemblage of slivers into a strand or ready, and laying such strands or readies into a rope, such slivers aforesaid not being previously separately twisted, or if so twisted, having no greater amount of twist than four turns in a length of one foot of sliver.

JOHN PLATT, of Oldham, engineer, and RICHARD BURCH, of Heywood, manager. *For certain improvements in looms for weaving.* Patent dated July 3, 1851.

These improvements have relation to the weaving of striped or checked fancy fabrics, and consist—

1. In a peculiar construction or formation of tappet-chain, for the purpose of actuating the movable shuttle-boxes, in conjunction with suitable arrangements for connecting the same to the movable shuttle-boxes.

2. In a peculiar arrangement and adaptation of endless tappet-chains, for the purpose of forming the shed or opening in the warp threads through which the shuttle passes, and also in a peculiar straight form of the treadles for actuating the jacks.

CHARLES BARLOW, of Chancery-lane. *For improvements in rotary engines.* (A communication.) Patent dated July 3, 1851.

Claims.—1. A revolving steam-wheel, having projecting rims or flanges, or being otherwise fitted, and revolving within the interior of a stationary cylinder in which there are two or more abutments or stops, which fit steam-tight, so as to close and divide the annular space between the cylinder and wheel into two or more steam chambers, the said steam-wheel having four pistons, whose operation is controlled by a stationary curved groove or way in each cylinder-head, so as to be alternately acted on by the steam in the cylinder and drawn within the wheel, so as to pass and clear the abutments or stops.

2. A peculiar construction of six-way cock, or steam-head, having a steam passage leading to its plug-seat, two steam passages leading from the plug-seat to opposite chambers of the cylinder, two exhaust passages leading from opposite chambers of the cylinder back to the plug-seat, and one passage leading from the plug-seat to the exhaust pipe—the cock plugs being provided with suitable openings and passages to make communication to or from the steam and exhaust pipes to either division of the cylinder, or to close both.

3. A mode of uniting the face and side packing pieces of the pistons and abutments, so as to make them steam-tight at their corners, by dovetailing them in manner described.

4. A mode of packing the sides of the packing rings or packing pieces of the several parts of the engine, by turning grooves in them, and fitting the said grooves with some soft metal or metallic alloy, which

admits of their being easily ground and fitted in their places.

WILLIAM HAMER, of Manchester. *For certain improvements in looms for weaving.* Patent dated July 3, 1851.

The improvements claimed under this patent are—

1. The adaptation to and employment in looms for weaving or manufacturing textile fabrics, of sliding, expanding, and contracting temples and their connections, operating in a self-acting manner, for the purpose of stretching the fabric and maintaining it in a state of tension as manufactured.

2. The adaptation to or employment in looms for weaving or manufacturing textile fabrics of stationary checker bars, whether of wood or metal, if affixed to the framing of the loom, and of wood if affixed to the moving parts of the loom, arranged and acting for the purpose of checking the movement of the picking sticks after the throwing of the shuttle.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Thomas Barnett, of Kingston-upon-Hull, grocer, for improvements in machinery for grinding wheat and other grain. January 8; six months.

Joseph Addenbrooke, of Bartlett's-passage, London, envelope manufacturer, for improvements in the manufacture of envelopes, and in machinery used therein. January 8; six months.

Charles Dickson Archibald, of Portland-place, Middlesex, Esq., for improvements in the manufacture of bricks and other articles made of plastic materials, and in cutting, shaping, and dressing the same, as also stone, wood and metals, and in machinery and apparatus employed therein. (Being a communication.) January 8; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Jan. 2	3174	John Ferrabée	Stroud	Grass-cutter.
,,	3175	John Hughes	Lee, Kent	Nursery yacht.
,,	3176	Victor Anglers	Fitzroy-square	Design for brushes.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

Jan. 2	346	Thomas Good	Church-street, Soho	Somatometer, or self-acting indicator of the figure.

CONTENTS OF THIS NUMBER.

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Edited by J. C. Robertson, 166, Fleet-street.

BOGGETT'S PATENT GAS BATHS AND KITCHENS.

Fig. 1.

Fig. 2.

Fig. 3.

BOGGETT'S PATENT GAS BATHS AND KITCHENS.

We now fulfil a too long unfulfilled promise (vol. liv., p. 299) to present our readers with some exemplifications of Mr. Boggett's new method of applying coal-gas to heating as well as lighting purposes.

Fig. 1 represents a GAS BATH, which possesses in a pre-eminent degree the three most essential properties of such an apparatus—first, portability, the whole weight, when made in zinc, not exceeding what a couple of hands can readily move; second, convenience of use, the gas-burner being attached to the bath, and lighted in an instant; and third, accessibility in every part for purposes of cleansing and repair. The water is heated by a cluster of hollow vertical plates, placed at the foot of the bath, in close proximity to the burner, and it can be raised in less than twenty minutes to a temperature of 110° Fahr. The lighting is effected by drawing out a horizontal tube, perforated at top with a row of holes; then letting on the gas into this tube (by a small tap not shown in the figure); and next applying a light to the jets of gas emitted from the row of holes; after which the tube is turned round on its axis, and applied to the lighting of a series of larger burners.

Fig. 2 represents a portable gas kitchen, which much exceeds any apparatus of this description which we have yet seen for its exceeding cleanliness and entire freedom from unpleasant smell. It owes its superiority in these respects to this circumstance, that in all those cooking operations, where the article to be cooked is exposed to the direct action of the heat, as in roasting and broiling—the heat is applied downwards instead of upwards, as usual—whereby the possibility of any of the gas vapours coming in contact with the food, or of any unconsumed particles of carbon being deposited in the shape of soot, is completely avoided. Heating by ascent is confined to the processes of boiling, stewing, and baking, in which the articles, being placed in covered vessels, run but small risk of being affected. Where the gas used, however, is pure—as it may, and ought to be in all cases—it imparts no perceptible flavour in any case to the food cooked by it; much less so, indeed, than coal or wood. The saving in expense is something quite enormous. One of these kitchens, covering a superficial space of not more than a foot square, and with one burner only, consumes but 12 cubic feet of gas per hour, at a cost of less than three farthings; and it will at one and the same time do all the roasting and boiling required for a large family.

Fig. 3 represents a gas-pot for heating soldering-irons.

BOGGETT'S PRISMATIC REFRACTORS FOR GAS-BURNERS.

Mr. Boggett has also recently patented an exceedingly useful application of optical science to gas lights, whereby they are increased full threefold in brilliancy, without the slightest additional expenditure of gas. It consists simply in placing a long prismatic lens on each side of an argand burner, as represented in fig. 4 on our front page, by which the appearance of three perfect flames, all of equal power, is produced. These lenses may be applied to any description of burner whatever, but the patentee prefers, of course, his own burner, with lateral jet-holes, patented by him in 1850, and now generally known as "the smokeless burner."

MR. BABBAGE ON THE GREAT EXHIBITION.

(Continued from page 35.)

We return to the question, What has England done for Mr. Babbage?

We mentioned before that so long ago as 1815 and 1816, two elaborate Memoirs, on the Calculus of Functions, were published by Mr. Babbage in the "Transactions of the Royal Society,"—they formed a complete treatise on the subject, as we have said, of the greatest importance to English mathematical science. We had nothing like it, and the author has since, in different modes, done much to show our mathematicians the various applications of this branch of analysis. The Royal Society professes to give medals to the successful cultivators and improvers of such sciences. Has the Society

complimented its distinguished member for his masterly essays on a subject which, at the time they were published, was new to philosophy, and for his other valuable labours in this department? We have examined the "Philosophical Transactions," and if the Royal Society has had the discretion to give Mr. Babbage one of their medals for his unique and original memoirs on this topic, we have been unable to find any evidence of the fact. Again; Mr. Babbage's invention of mechanical notation was as novel as it was extensively serviceable—a memoir on the subject was published in the "Philosophical Transactions." Did that extension of human knowledge meet with the Society's chief mark of approbation? We cannot find that it did. How can this have been? Are the memoirs which carry off the medals so transcendantly scientific that even such essays as Mr. Babbage's stand no chance—or, at all events, are not so distinguished? We cannot exactly say; but if common report may be relied upon, there is a ruling clique (of which Mr. Babbage, to his praise be it said, is not one,) who have usually been in the practice of shuffling for the medals. And the shuffling is somewhat after this fashion: One puts aside Mr. Babbage's papers as too mathematical to compete for the medals awarded to philosophy; while another pronounces them to be too philosophical to gain a medal adjudged to mathematics; and so between them the papers are passed by altogether. We have been told that, much in the same way, the masterly memoir on the "Geometrical Investigation of the Laws of Magnetism," by our revered and lamented friend, Professor Davies, was treated. Davies, like Mr. Babbage, stood no chance for a medal which depended upon a shuffle. Look again at the treatment Mr. Babbage has received in regard to the Great Exhibition. There was not a scientific man of any note in the universal gathering in Hyde Park, come from what country he may, to whom the name of Babbage was unknown; nor has there been a single visitor who has seen any machine like Mr. Babbage's, even in its incompleted state—there is nothing, in fact, like it in the world. The renowned men, who have visited the Crystal Palace, may well have asked, "Why do we not see the name of Babbage in the list of the Royal Commissioners—and where, in this magnificent collection of the works of science, the *chefs d'œuvres* of all nations, can we find the Difference Engine that has added a lustre to the glory of this country?" How greatly must such inquirers have been surprised when they heard that Mr. Babbage had had nothing to do with the Exhibition, and that the ENGINE WAS NOT IN THE PALACE! How astonishingly different is the treatment of men of science in other countries—which we are taught to look upon as *less civilized than our own!* We will give an instance which the *Illustrated News* for September 20th, supplied, under the head *Stoffel's Calculating Machine.* Mr. Stoffel is a native of Warsaw, and sent his machine to the Exhibition of that city; a Committee of Professors of the Academy was appointed to examine it, who expressed their high approbation of the invention, and concluded by saying that the inventor deserved the highest reward and support. For this support and appreciation, Mr. Stoffel did not look in vain. The Prince Paskewitch Erivausky, Lord-lieutenant of the kingdom of Poland, having been made acquainted with this important invention, sent for the inventor to produce his machine at the vice-regal lodge, and having by occular demonstration convinced himself of the importance of the invention, enabled Mr. Stoffel to present his machine at the Imperial Academy of St. Petersburgh, which reported in its favour. Under the same high patronage, he was afterwards presented to the Emperor, who was so gratified with his invention, that he ordered a sum of 1,500 silver rubles to be paid to him as a gratification, out of his private purse. No doubt, Mr. Stoffel's machine is a very ingenious contrivance. The Jury have awarded him a medal for the invention; but giving it the fullest credit for the performance of all that it pretends to do, it is a mere bagatelle when

compared with the invention of Mr. Babbage, if any such comparison can be made. Let the reader contrast the treatment which has attended Mr. Stoffel's invention with what Mr. Babbage's has experienced. Mr. Stoffel met with warm friends in the Professors near him—a powerful advocate in the Prince presiding over his country, and was honoured by the countenance and munificence of the Imperial Czar. And, lastly, his invention has been distinguished by obtaining a medal at the Grand Exposition of all Nations. On the other hand, Mr. Babbage, *at the wish* of the Government, undertook to construct a Difference Engine which should print its results; he continued to work at the engine from 1822 to 1834, refusing in the mean time other sources of profitable occupation, one of which was an offer of about 2,500*l.* a year. Besides a long term of incessant labour, for which he received no acknowledgment, he spent upwards of 20,000*l.* in making experiments; and for all this, he tells us, that every application for a suitable appointment in the public service was unsuccessful, and the crowning act of the Government patronage in the matter has been that they have not placed the Difference Engine in the Exposition of the Arts and Sciences of all Nations! The most astonishing piece of mechanism that human ingenuity has ever conceived and carried into effect, is the production of an Englishman; and the surprising invention has been kept in the background by its patrons!! The engine would have added to the national credit, high as it stood, in the light of the universal concourse; for invention and mechanical contrivance, the country has been deprived of that credit, and common justice to English science has been perverted. We desire
all this has happened? How
Babbage's valuable Memoirs,
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ighting neglect? How is it
f ill-fortune has attended all
That is the reason that his long
ital exertion, of an Herculean kind, in the cause of British science has brought him only personal loss; and, to some extent, public reproach? That England should invite all nations to send their chief works of arts and productions of science to the grand Diorama—and keep the most surprising work in existence—contrived and brought to perfection by one of her own sons—shut up from public view? Why has Great Britain encouraged all the illustrious men of science in the world to come to the universal assemblage, and to display to the world what they reckon as their chief works, and has kept one of her most noted and widely-known men of science, as well as the astonishing productions of his inventive powers, in the shade? These are questions that must spontaneously occur. Can the Reader answer them? If he cannot, let him peruse and ponder on the following simple narrative taken from the chapter on "The Intrigues of Science," in the book before us—if we mistake not, it will thoroughly explain the mystery which, at first sight, appears to overshadow the subject:

By some strange combination of circumstances, a quarrel in which I had no part, and with whose origin I am unacquainted, seems to have had an unanticipated effect in impeding the construction of the Calculating Engines.

At the time of the foundation of the Astronomical Society, Sir James South, whose observatory and whose house were hospitably open to every cultivator of astronomy, was on terms of intimate friendship with almost all of those persons at that period most eminent in science. It is sufficient to mention the names of Wollaston and Davy, and to add that when the late Mr. Fellows was appointed Astronomer at the Cape, although previously a stranger, he became for several months the guest of Sir James South, who assisted him in acquiring that practical knowledge of instruments so necessary in his new avocation.*

In 1829, Sir James South was elected President of the Astronomical Society. It now appears, however, that previously to

* Sir James South, in conjunction with Sir John Herschel, completed the examination of 380 double and triple stars; a work for which the authors were awarded the great astronomical prize of the Institute of France in 1825, and the medal of the Astronomical Society of London in 1826.

this appointment, *a party had been formed* adverse to Sir J. South, which party, with the view of thwarting him, placed in the office of Secretary the Rev. Richard Sheepshanks, Fellow of Trinity College, Cambridge.*

In March, 1831, the Board of Visitors of the Royal Observatory of Greenwich, met at the Admiralty, to consider the propriety of separating the duties of Superintendent of the Nautical Almanac from those of Astronomer Royal. The new arrangement was advocated, amongst others, by Sir J. South, and after some discussion, in which Capt. Beaufort and myself took part, it was ultimately carried. As we were leaving the meeting-room, Mr. Sheepshanks, addressing me, said: "I am determined to put down Sir James South, and if you and other respectable men will give him your support, I will put you down." He at the same time told me he "intended to put Captain Beaufort down."

During the course of 1832, it was found that the large equatorial mounting which had been contrived and executed by Troughton, for his friend Sir J. South's twelve-inch object-glass, was an entire failure. This produced at the time a difference between two friends who esteemed each other highly, and who had been for years united by reciprocal acts of kindness in ties of "*very intimate*" friendship. Well acquainted myself with the character of the parties, and the circumstances of the case, I have not the slightest doubt that this unfortunate affair might easily, by the exertions of judicious friends, have terminated in the entire restoration of their former friendship. But this was a course which the Rev. R. Sheepshanks took effectual means to prevent. Having himself a "*personal*" quarrel with Sir James South, he "*offered*" his services to assist Messrs. Troughton and Simms. He "*offered to go*" himself to examine the instrument in Sir J. South's Observatory, and "*got his friend, Professor Airy, to go with him*," for the purpose of remedying the defects of the equatorial.

Notwithstanding he was told by Mr. Simms that "*Sir J. South had declared that no person could have been pitched upon more obnoxious than yourself*," he still persevered in obtruding himself into Sir J. South's Observatory as the agent of Troughton and Simms, until it was at last discovered that no after contrivances or expense could correct the errors of an instrument itself radically defective in principle.

It may readily be supposed that the continuance for months of these visits by Mr. Sheepshanks and Professor Airy, and the *irritating correspondence* consequent upon them, which, though *nominally* that of Troughton and Simms, was really "*directed by*" the Rev. R. Sheepshanks, destroyed all hope of a reconciliation. The parties then had recourse to the Court of King's Bench, and it was curious to observe the vigour and energy with which the Rev. R. Sheepshanks applied himself to the exercise of his earlier studies.*

Having *volunteered* his services to Messrs. Troughton and Simms—he "*wrote every letter*" for them during the subsequent lawsuit—he acted for them in all the various characters of "*friend*" and "*adviser*"—of "*workman*" and "*agent*"—of "*attorney*" and "*counsel*;"† he made an "*affidavit*" in the case—became a *witness* himself—and undertook to *intimidate witnesses* on the opposite side.

This latter performance is fortunately rare in England, and is so remarkable that it is necessary to give some account of the proceedings.

Not wishing to become involved in so disagreeable a case, I had refused to be a witness on the part of Sir J. South. Having, however, had some conversation on the subject with the late Lord Abinger (then Mr. Scarlett), he represented to me that my evidence was essential for the justice of the case, and upon that ground I reluctantly waived my objection to appear as a witness.

Having been examined in chief on the seventeenth day of the Arbitration, I remained in the room a few minutes after the Arbitrator had left it. The Rev. R. Sheepshanks, the only other person then present, addressing me, said, "it was necessary to *discredit me* because I had supported Sir J. South." He added, that "he would, at a future time, *attack me* publicly on *another subject*, on account of the part I had taken in this matter."

The remembrance of his former threats more than four years before at the Visitation at the Admiralty, added to the knowledge of the unremitting perseverance with which he had carried on his hostility to Sir J. South, satisfied me that it would be unsafe for the cause of truth, and possibly injurious to myself, if I were not to take measures for making known the nature of the weapons which the Rev. R. Sheepshanks was em-

* "When he (Sir J. S.) was elected President, I (Rev. R. S.) was elected Secretary to keep him in order."

* At an earlier period of his life, his studies were directed towards the profession of the law.

† On the 19th July, 1836, at the 23rd meeting under the Arbitrator, the Rev. R. Sheepshanks *cross-examined* Mr. Savage, the architect.

ploying. As he had ventured, *after* my having given evidence on oath, to threaten me with injury, with the hope of inducing me to modify that evidence on cross-examination, it appeared to me probable that he might have been tampering with the evidence of other witnesses in the same cause, who from their position or circumstances in life, might be compelled by the fear of his vengeance to shape their evidence so as to adapt it to his views.

The Rev. R. Sheepshanks discovered on reflection no impropriety in this course of intimidating witnesses, or of attacking those who could not be induced to take up his own private quarrels. He thus defended both.

"*I think it allowable to throw down the gauntlet in this manner.*"

"*I have another ground of dispute with Captain Beaufort, and certainly intend to put him down.*"

The gallant Admiral has survived many a dangerous day, and needs not the pen of a friend to protect his honest and well-earned fame.

The reader may perhaps be astonished at the statement made in the preceding pages, and feel disposed to consider it an *ex parte* statement. It *is entirely* an *ex parte* statement: it is not necessary for its support that the reader should give credence even to that small part of it which appears to rest on my own evidence before the Arbitrator. *The whole of it is founded entirely on the testimony of the* Rev. R. Sheepshanks *himself.* Every statement of those which are marked as quotations was either elicited from him on his cross-examination, or in the few instances in which it came from myself, its correctness was confirmed by his subsequent admission or re-statement. After my statement, and the Rev. R. Sheepshanks' reply to it, the Arbitrator, addressing him, said—

"With respect to the matter of fact, you agree?"

Rev. R. Sheepshanks. "Yes, we agree as to the matter of fact."

Professor Airy, who was afterwards appointed Astronomer Royal, had long before become as deeply engaged as his friend Mr. Sheepshanks in this most unfortunate quarrel. Years of aggravating delay and discussion resulted from the procrastinated reference, and at length one of the parties, Mr. Troughton, being dead, a decision not satisfactory to either was given in December, 1838. But the inextinguishable desire "to put down Sir James South" survived the lawsuit, which was only used as a means, and reappeared from time to time through the aid of the press, in forcible but somewhat unmeasured charges and recriminations between the Astronomer Royal, the Rev. R. Sheepshanks, and others on the one side, and the astronomer of Campden Hill on the other.

It was a curious, though a very painful study, to observe from time to time the various consequences of this feud.

Against those men of science who refused to forsake their ancient social relations with Sir James South, a system of disparagement was maintained which could not fail in the course of time to produce its effects. The avowed object of the party of which the Rev. R. Sheepshanks was the organ, was, in his own expressive words, to *discredit and put down every respectable person* who supported Sir J. South.

It was melancholy to observe the gradual change in the expression of opinions by some of these qualified from their knowledge to guide the opinion of the public. Intimidated at first into silence, the uncontradicted assertions of those around them then got possession of their minds, until at length, without any new examination, they were flattered into an acquiescence in, if not indeed into the expression of, opinions entirely opposite to their former ones. These new views were doubtless conveyed by their flatterers to other ears, and thus the process of "*discrediting every respectable person*" opposed to them, was carried on under the authority of honourable names.

One after another almost all Sir James South's old friends and acquaintance amongst *men of science only, however*, were alienated from him.

One man was alarmed by the fear that some inaccuracies in his astronomical publications should be severely criticised. Of another it was hinted that his mathematics were all wrong, and might be shown up.

Those who were timid feared the anger of the dominant party; those who were young might have their prospects blighted by even appearing in friendly relations with him who supported the unequal conflict; those who were old loved repose, and found it easiest to appear to side with the most numerous party; whilst those who saw through the whole of it, had better things wherewith to occupy their minds, than to attend to such affairs.

It is obvious to all who have observed society that such a system of "*discrediting*" carried on for a series of years, especially against one too much occupied or too proud to expose it, must end in establishing the set of opinions propagated by the party. Honest and even tolerably well-informed persons, will at length be misled, and be found to adopt them.

* * * *

It is always difficult to trace intriguers up to a direct intercourse with Government. In the present case, the vanity of some of them overcame their judgment, and they gave themselves out as advisers of the Government on scientific subjects. To these I shall not at present refer, but confine myself to citing from official documents two cases of direct communication with the Government by persons on whose judgment it appears to have relied.

The Whigs seemed to have had great confidence in the devotion of the Rev. R. Sheepshanks to their interests, since they took the extraordinary step of appointing him, although a clergyman, one of the Boundary Commissioners under the Reform Bill; and he is, I believe, at present, one of the Standard Measure Commission.

The Astronomer Royal, besides his situation at Greenwich, has been a member of several Commissions:

The Tidal Harbour Commission.

The Standard Measure Commission.

The Harbour of Refuge Commission.

The Railway Gauge Commission.

The following are extracts from his Annual Reports:

"The Board of Admiralty, on my representation of the interruption to our business caused by the rating of so many chronometers, and *by my own employment on public business unconnected with the Observatory*, immediately sanctioned the employment of an additional computer."—*Astron. Royal, Rep. June* 1841, p. 7.

"On former occasions I have avowed, without scruple, that I do not consider the Royal Observatory as a mere isolated place for the conduct of astronomical observations. I consider it a part, perhaps the most important part, of the scientific institutions of this country."—P. 18.

"In concluding this long Report, I have been uniformly supported by the *confidence of the Government.*"—*Astron. Royal, Rep. June* 1844, p. 20.

The following extract of a letter from the Astronomer Royal to the late Sir Robert Peel, shows that his time was so occupied with the labours of the Railway Gauge Commission, that he was unable to draw up a memorial which he had himself proposed, even though it related to an astronomical subject—our Colonial Observatories.

. . . . "I have been so closely employed on the papers of the Railway Gauge Commission, that it has been impossible for me to draw up a memorial before the present time. . . . . "April 16th, 1846.

"To the Right Hon. Sir Robert Peel, Bart, &c."

"By the giving opinions on subjects of railways and *other mechanical matters referred to me by Government*, it has appeared that our energies are not wholly absorbed in the mere astronomy of the Observatory."—*Astron. Royal, Rep. June* 1846, p. 10.

(N.B. The italics do not occur in the original quotations.)

Now it is evident from these extracts from Reports of the Astronomer Royal to the Board of Visitors, and from other facts, that he wishes himself to be considered the general referee of Government in all scientific questions.

The office of Astronomer Royal is one of great importance: it requires the undivided energy and talents of one person; and great as Mr. Airy's abilities undoubtedly are, yet it is highly injudicious to divert them from their legitimate object,—the direction of the many arduous duties of the establishment over which he presides.

During many years I have frequently found, in my communications with members of Government on subjects connected with the Calculating Engines, difficulties on their part which remained entirely unexplained;—unseen obstacles which were never alluded to, but whose existence could not be doubted.

Although frequently warned by personal friends that it was unwise to neglect such machinations as those which I have, at length, been reluctantly compelled to expose; yet I was unwilling for a long time to believe that they were directed against myself.

I have now traced the connection of the Rev. R. Sheepshanks (who had avowed his determination "*to discredit me*," and also to "*attack me on another subject at a future time*"), through his friend the Astronomer Royal, with the Government. According to the Astronomer Royal's own statement, he was their adviser on all scientific subjects. The Government had no other official adviser, and would scarcely have ventured to decide upon points connected with some of the most profound questions of mathematics, on their own responsibility.

There are, I am aware, other channels than those of official reports, by which the Government may have been influenced.

If the Astronomer Royal has maintained that the Calculating Engines are either useless or impracticable, then the grounds of that opinion *must* have been stated, and, if published, the solidity of those grounds might be examined.

The preceding narrative discloses as gross an outrage as was ever perpetrated upon

honest independence, followed up by a persecution as vindictive and abominable as it is un-English and unprecedented. The Author states that *after* he had given his evidence, he was *threatened with injury*, with the hope of inducing him to modify that evidence upon cross-examination. If this be not subornation of perjury, it is very like it. To induce another to commit a misdemeanor is itself a misdemeanor. But waiving the legality of the threat, what can be said of its morality? The *threatener* is still a leading member of the Royal Society, and the very *arbiter elegantiarum* of the astronomical. What thinks the noble President of the Royal Society of the menace? Does he allow one of his Fellows to threaten another most distinguished member with injury, to induce him to modify evidence given upon oath, and to let the scandal pass unheeded? *The matter has been brought to his Lordship's attention*, we believe, but hitherto without any result. Does the noble President wish to have the public understand that the members of the Royal Society may outrage all the decencies of life with impunity as far as he is concerned? Has he nothing to say on behalf of the Society over which he presides? Has the noble President nothing to disavow on his own account—or is he willing that the public should infer that there is nothing uncommon in Mr. Babbage's statement—that it is only characteristic of the Society, and that he, the head of the Society, has no censure to bestow on it. The President is not a mere titled dilettante—he is a laborious and successful cultivator of science, and has given convincing proofs of being its real friend. We therefore trust that the noble Lord, as the nominal head of the British science, will not permit the atrocity set forth in Mr. Babbage's book, and which we have cited above, to pass without publicly giving his opinion upon it.

From Mr. Babbage's statements—on the correctness of which we are confident every reliance may be placed—it is but too manifest that the Astronomer Royal and his "putting-down" confederate, Mr. Sheepshanks, have been the real authors of those "*unseen obstacles*" and "unexplained difficulties" which have been thrown in the way of his communications with Government, and led to the entombment of the Calculating Engine and maltreatment of its illustrious author. Have the Government, as patrons—or, at least, the supposed patrons—of science, nothing to say on the matter? Are they satisfied to stand in the light in which Mr. Babbage's *exposé* places them? or does each member shirk the question by saying, "*I* have nothing to do with it?" Is there no member of the House of Commons sufficiently embued with regard for the scientific credit of his country to inquire—What is the public institution called the Royal Observatory, at Greenwich?—Whether it be supported at the public cost, for really astronomical purposes, or whether it has become an expensive *sham?* Has the renowned institution been converted into a cover under which a scientific cabal concoct their schemes for "*putting down*" obnoxious men of science? If this be one of its uses, let the English people become acquainted with the fact, that they may form an opinion upon it. The establishment is of long standing, and was intended to be of great public importance. Does it continue to answer the ends for which it was founded? or has it been changed into another kind of institution, carried on under its original name? Unless Mr. Babbage is in error, these questions require an answer; the public have a right to demand it, and we trust that they will press for it. The public officer, nominally at the head of the institution, is still called "Astronomer Royal." Are his duties confined to the stars, like his great predecessor's, or is that title at present conferred on a public officer who is permitted to do everything he likes, provided he holds himself ready to enter upon any kind of Government work, however unastronomical it may be? A perusal of Mr. Babbage's book irresistibly suggests these inquiries, and, in our opinion, they cannot be satis-

factorily answered without a slight sketch, showing what the performances of Astronomers Royal have been, and contrasting their duties with those of the present holder of the office.

The foundation-stone of the Royal Observatory was laid in 1675, by Mr. Flamstead, who was appointed first Astronomer Royal, with a salary of 100*l*. per annum! He has left us the *Historia Celestis Britannica* and other works as memorials of his assiduity and accuracy.

Dr. Halley succeeded Flamstead. We are told that when the Queen Consort proposed to have his salary of 100*l*. a year increased, Halley, alarmed, replied—"Pray, your Majesty, do no such thing; for should the salary be increased, it might become an object of emolument to place there some unqualified, needy dependent, to the ruin of the institution." Though he was upwards of sixty years old when appointed, he watched the heavens with the closest attention during eighteen years, hardly ever missing an observation in the whole time, and, WITHOUT ANY ASSISTANCE, *performed the* WHOLE BUSINESS *of the Observatory himself!!*

Halley was succeeded by Bradley, the celebrated discoverer of the earth's nutation and the aberration of the fixed stars. He, during upwards of twenty years, pursued his astronomical labours with such assiduity as to leave thirteen folio volumes of observations. The King, for his meritorious labours, granted him a pension of 250*l*. a year, in addition to the original stipend of 100*l*. a year.

The next Astronomer Royal of note was Dr. Maskelyne, who, in 1765, succeeded Mr. Bliss. On his appointment, he recommended the Lunar Method of finding the longitude to the Board of Longitude, and induced that body to have a *nautical almanac* calculated to facilitate that method; the first No. of which was published in 1767, and which was continued *under his direction* with the greatest credit through forty-eight successive years. During this lengthened period, we are told that he diligently watched the heavens, *hardly ever quitting the Observatory*, and rendered innumerable benefits to the nation as well as to individuals in all the arts and sciences connected with astronomy and navigation. This justly celebrated public servant had church preferment, and paternal estates; but it does not appear that he obtained a larger stipend for his invaluable public services than the sum before named.

Mr. Pond was Astronomer Royal for many years; but here we stop to contrast the official labours of past Astronomers Royal with what appeared to be the duties of the present one. We may observe, in the commencement, that we have always been ready and willing to acknowledge the great abilities of the present Astronomer Royal; we have again and again spoken in justly deserved terms of approbation of several of those works which he published before he became a servant of the public; his acquirements fully justified his being appointed to fill the highly honourable and very responsible office that he occupies, and if he has not excelled all his predecessors in adding to the celebrity of the Royal Observatory, the failure cannot be attributed to his want of ability, or to a deficiency of adventitious aid.

If "Astronomer Royal" were a proper title when applied to Bradley and Maskelyne, it is a deceptive misnomer to give it to Mr. Airy. He—judging from his annual reports—officially employs himself as astronomer, chiefly in going to the Continental observatories to see what they are doing; he travels as an astronomical Mantalini to ascertain the newest fashions, and, on his return, the old Observatory is turned inside out, and upside down, to make room for them. The instruments to which the Institution owes much of its celebrity are removed to sheds and lofts; and their illustrious inventors and makers are officially calumniated in the record of their removal. We have seen that Halley did the whole work of the Observatory for 100*l*. a-year—That for 360*l*. a year, Bradley, besides actually performing the official duties of the Observatory—completed inquiries connected with astronomy that rendered the Observatory renowned throughout the world—That

Maskelyne, during nearly fifty years, in addition to the important services which he rendered to the country as Astronomer Royal, superintended the making and compiling the "Nautical Almanac," a publication of incalculable benefit to this maratime nation, and was paid only 360*l.* a year.

How stands the matter now? In the first place, the "Nautical Almanac" business forms a separate public establishment —having a superintendent and a proper staff for its purposes. We mention this only to show that the present Astronomer Royal has been relieved from a most important and weighty duty which Dr. Maskelyne for so many years discharged. Moreover, the Astronomer Royal now has what he terms "a chief assistant"—a *reverend* personage, who is paid 450*l.* a year; it is not easy to point out the duties of this newly-made appendage to the Observatory —he would appear to be a kind of chaplain to the Astronomer Royal, supplying him, no doubt, with domestic divinity, as well as being his chief tool. There are other talented men engaged at the Observatory whose remuneration for their brainwork is disgracefully low—it is a scandal to the country to pay men for the rigid exercise of such acquirements such paltry sums. But with such onerous duties removed from the Astronomer Royal's care, and with an assistant paid more than Bradley or Maskelyne received, surely the celebrity of the Institution continues to increase. Does it? —How?—Where? Professor Loomis has published a most interesting account of many brilliant discoveries in astronomy during the last few years—if any of them were made at the Royal Observatory, Greenwich, the Professor has omitted to name it. Adams, Hind, Lassell, and a few others, have sustained the national credit for astronomical discovery: but the Royal Observatory, supported at the public cost, is become, under present management, a dead blank in the relation of astronomical discovery; the Astronomer Royal keeps his dogs, it seems, to bay the moon—discovery is not encouraged.

It may, perhaps, be alleged that the Astronomer Royal is so miserably paid, that the public cannot reasonably expect him to add much to its credit in his official capacity. Were it so, it might be replied, that he knew the amount of remuneration before he accepted the office, and that therefore his stipend, be what it may, forms no excuse for his not maintaining, and extending if he can, the renown of the Royal Observatory. However, Mr. Babbage tells us that the present Astronomer Royal is in receipt of 1,300*l*, a year, including a pension of 300*l.* a year, besides an official residence. We have not, however, mentioned the fact that the public pays the present Astronomer Royal nearly four times as much per annum as it paid the indefatigable Dr. Macskelyne, and thirteen times as much as it paid the celebrated Halley, by way of finding fault with the larger payment—far from it. We should like to see, and we hope to see, the Astronomer Royal as the head of English science, paid as munificently as any public officer in the kingdom, and after duly discharging his most important functions—among which, in our opinion, is the encouraging and fostering of English science to the utmost of his power—we should rejoice to hear her Majesty conferring on him the highest distinction that she can bestow—that, instead of insulting science with the infliction of a knighthood upon its most distinguished cultivator—just the same distinction as is fastened on the well-fed mayor of a borough —and not so permanent or high a one as that conferred on the caterer of a metropolitan corporation dinner; she would ennoble one of Nature's real nobles, and show to the world how highly the British Sovereign appreciates distinguished merit. But the man whom we wish to be so honoured, must not only possess the rare talents required for the office, which Mr. Airy undoubtedly does, but energetically employ them (which he does not) in the conscientious discharge of his duties. He must in reality be Astronomer Royal—not the mere jack of all work to the Government of the day; one that will perform his own official duties himself, and not hand them

over to substitutes, whilst he is employing himself about schemes that end in nothing, or are at least scouted as being altogether impracticable; or what is still worse, co-operating with some priestless miscreant in unprincipled plots, "*to put down*" worth and genius. We repeat with all sincerity, that were the Astronomer Royal really what the title conveys, we should like to see his stipend—considerable as it is in comparison to the salaries paid to his laborious predecessors—very much larger; but as things stand, the public money paid to him is paid apparently for one purpose, and in reality for another; it is a deception upon the public,—it is held out, as the salary of the Astronomer Royal, whereas, in fact, it is the payment to a performer of all kinds of Government jobs.

(*To be continued.*)

FORMATION AND SETTING OF SHIPS' SAILS.

Mr. Editor,—As the formation and setting of vessels' sails may probably prove an interesting subject for discussion before the next yachting season, I send you a sketch of a little pleasure-boat which I had rigged on my plan with a revolving mast, together with some explanatory remarks regarding the setting of sails. The most perfect sail I should imagine to be that one which

stand as flat as a board, and is a moveable *plane*, with its axis on a line with it, and which can be placed in any position, so as to receive the fullest or the least effect of the wind's power; there are other slight improvements, which I may mention hereafter. The revolving sail shown in the sketch accomplished all those qualities as nigh as practicability would admit of. In the first place, as regards fleetness, the foot of the sail is laced to a fixed boom and bowsprit, which are all in one; and as there is little or no spring at either end, the sail admits of being hoisted up quite "taut" without a wrinkle; and, as it moves *with* the mast, and not *around* it, it is never deranged from its drum-like set. Now let this sail first be compared to the main sail of a cutter, which latter we will suppose to be laced to a boom, by way of making it stand as flat as possible; when hoisted it has only the weight of the boom to maintain the flat surface, which a good breeze will lift up; then, again, the gaff having its fulcrum at its jaws, or fore-end, sways to leeward, and thus forms a different angle to the boom, and consequently the after leech also, so that it is not a *plane surface*, notwithstanding it is a powerful fore-reaching sail, having its axis on a line with the fore-leech, and consequently, its whole area on one side. The greatest credit is due to our sailmakers for the ability they have shown in making this sail as perfect as perhaps is possible; for instead of tight-roping the after-leech, which would have caused a bag, they have done away with the latter altogether by their manner of stitching the cloths, so that the after cloth may shake when the vessel is close-hauled.

Jibs and stay-sails are very imperfect sails, the more especially so when their luffs or heads make great obtuse angles to their masts; so far are they from being moveable planes, that their luffs are always in a "fore and aft" direction, on every point of sailing, consequently the canvas attached to them must be in part so too, from whence arises the nautical term a "dragging sail," meaning propelling a vessel sideways, or having a tendency to do so; it is true that our sailmakers have shown their ingenuity in doing their best to lessen the "dragging" evil, by contriving the sail to belly the whole length of its luff, yet as bellies to sails (as regards sailing close handed) are now exploded, much, perhaps, was not gained by substituting a belly for a "drag." It appears to me that the cleverness of English sailmakers has been taxed to do away with the evils inherent in sails on bad theoretical principles, and one cannot but admire what they have accomplished. A cutter's foresail only slightly partakes of the before-mentioned evil, on account of its luff being such a comparative acute angle with the mast; but I have seen the heads of ships' staysails almost horizontal, and, as in such cases, they are quadrangular sails, two of their sides, viz., their heads and luffs being stationary, their feet and after-leeches are the only two sides which can give the propelling power to the sail by altering its direction; such sails are so far removed from moveable planes, that they may be reckoned amongst the worst sails that were ever invented or adopted. I wonder how they ever came to be tolerated, —probably because stays were at hand to set them upon with great convenience.

If, Mr. Editor, I shall not intrude too much upon your valuable pages, I will in a future Number give you a sketch of a sail, showing the further improvements to which I have made allusion.

I am, Sir, yours, &c.,

MOLYNEUX SHULDHAM.
Commander R.N.

Bath, January 14, 1852.

MASTERS AND MEN.

The union of any body of men for the attainment of a legitimate object, is what no one can reasonably object to. "Union is Strength," and if the object contemplated be proper, union or combination for the purpose of securing its accomplishment, is not only justifiable, but highly to be commended. Almost every great advance in the development of the mental and physical resources of this country within the last fifty years, has been achieved through union; and of late years, especially, the desirableness, and even the necessity of combination, for the attainment of worthy and important objects, has become more and more apparent. Nor do we except from the operation of this principle such objects as may be contemplated either by a union of operatives or by a union of

employers. The operatives have a perfect right to place the highest valuation on their labour, and to arrange amongst themselves the terms on which they shall dispose of it. In doing so, they merely follow a practice which is usual in other markets besides the labour market. The employers, on the other hand, have a perfect right to enter into a defensive or antagonistic union, and place the highest valuation on their capital, at least that part of it which goes to pay wages, which is just equivalent to placing a low valuation on labour. Operatives and their employers are merely buyers and sellers; the former have labour to sell, the latter want to buy it; the former want as much money as possible for their labour, the latter want as much labour as possible for their money; and in arranging the precise terms on which the commodity of labour is to be had, both parties are likely to submit to an abatement in their demands. When, however, a Trades' Union is based on a compulsory principle; when a body of any particular class of workmen tell an employer not only that he cannot have *their* labour under a certain price, but that they will not allow him to go elsewhere for a supply,—when they say to a master, "You must employ us at so much wages, and you must not employ any who will work for less;" and when they say to a poor operative, who has been long out of employment, "Unless you subscribe to our union, and abide by the terms we have dictated, we will not work with you, but do all we can to annoy and obstruct you;" then it is quite clear that a union based on the principle of exacting such demands is unfair and tyrannical, and ought to be resisted and discountenanced in every possible way. A Union, constituted on such a foundation, exercises an undue control not only over the labour-market, but over capital; and if its right to exact such demands be once conceded, there will be no end to its tyrannous and oppressive dictation.

The history of the last few weeks proves conclusively that the Executive Council of the Amalgamated Engineers were fully persuaded of the advantage their union gave them over the masters from the want of combination amongst them. Dealing with the masters one by one, they easily reduced them to their own terms, and, emboldened by success, advanced other demands upon employers, such as the abolition of systematic overtime and piecework. Now, in anything we may say on this question, we beg to intimate most distinctly that we have no prejudice in favour of either of the belligerent parties, but in our remarks are simply actuated by a desire to come to a just, fair, and impartial conclusion in reviewing the points in dispute. The Amalgamated Society of Engineers contains many members of intelligence and worth, and it represents a class of workmen who hold the highest rank in what is termed skilled labour, and who, we may add, are universally acknowledged to stand second to no other class of workmen in the amount of wages they receive. We have already admitted their right to form a combination or union for the attainment of legitimate objects—such, for example, as the maintenance, or even the advance of wages; but when they aspire to control the masters with respect to the mode in which they shall conduct their business, and to hinder other workmen from reaping the advantages of their skill, adroitness, and industry, their union is so far vicious and tyrannical, because it is an interference with the liberty of the subject. What right have any set of men to say to a master, "However busy you may be—however soon that article may be wanted by your customer, you shall not allow a man in your shop to work more than the regular time?" The impudence and unreasonableness of this demand are alike conspicuous. If business were equally brisk throughout every month of the year, its unreasonableness might not appear so glaring; but who, that knows anything of the engineering business, does not know that the greater number of these large and expensive establishments have their periods of depression as well as their periods of activity, and that, during a great part of every year, the masters who have a large capital invested in these concerns, and whose current expenditure is at all times heavy, are considerable losers by their business? When, then, are they to retrieve themselves, if not during periods of activity—at those seasons of the year when orders come thick upon them, and require to be executed with all possible expedition? Everybody knows,

that in many large factories, *undertime* is about as frequent and "systematic" as *overtime*, and that masters, to keep their hands together, so as to be available for future contingencies, often keep them about the shop, at full wages, when there is little for them to do.

It is but reasonable, then, that at times when business is brisk, masters should have the benefit of some extra labour from those they employ, particularly when for that extra labour they pay a considerably augmented price. The qualifying term "systematic" has been prefixed to the word "overtime" by the Committee of the Amalgamated Society in their circular to the employers; and at the several meetings of the Society lately held in London, the speakers have emphatically declared that it is only systematic overtime, the abolition of which they demand; but who is to determine what systematic overtime is?—The employers, or the workmen? Or the sapient Executive Committee? When a master receives an order for a certain machine, to be executed within a specified time under a penalty, or with the alternative of its being left on his hands, which of these parties is to determine the urgency of the case? During periods of depression, when orders are few and far between, the question might with greater safety be left to the decision of the Executive Committee; but when orders come crowding upon a firm, demanding all their resources to have them speedily executed, we maintain that the masters, who are alone responsible to their customers, are the only parties who have a right to say when overtime is necessary.

The demand made by the Executive Council of the Amalgamated Society for the abolition of piece-work is as unreasonable and tyrannous as their requisition with respect to overtime. It is an attempt to overturn from its very foundation the relation which naturally subsists between the employer and his workman, or the buyer and seller of labour. This is so obvious that it seems almost unnecessary to say a word, either in its illustration or its enforcement. Piece-work is the only satisfactory and definite basis of negotiation between two parties in the buying and selling of labour or any other commodity whatever. There are exceptional cases where it may not apply, as in works of high art, or of extremely delicate manipulation, when it is impossible to fix beforehand the time, or even a close approximation to the time, in which such a work can be finished; but in all manual operations, the time of whose execution is pretty well ascertained, and which are capable of being executed in that time by any one of a certain number of men, piece-work is the most equitable and satisfactory basis on which a bargain can be made. There is no operative engineer who, in purchasing the labour of others, does not act on this principle. If he goes to a cobbler to get his shoes mended, and the cobbler should take two hours to do a little job that might have been finished by a more expert hand in one, he will not be so foolish as to pay for *time*, instead of the amount of work done; and if he should think afterwards of employing the handy cobbler instead of the clumsy one, and get his little order executed in half the time, he will not be so unreasonable as to say, "Oh, you have been only half the time finishing this job that the other man took, I will therefore give you only half the money I gave him." There is no man of sense—not even an operative engineer — who would act upon such an absurd and unjust principle. How unreasonable, then, is it that the Executive Committee of the amalgamated engineers should try to coerce the employers of engineers into the adoption of this plan, and compel them to give the same amount of wages to the lazy and awkward workman as to the industrious and expert! It appears to us an unwarrantable encroachment upon the liberty of the subject; and we hold that if in an engineering establishment, some men are capable of executing to their employer's satisfaction, a piece of work in a shorter time than their fellow-workmen, they should be entitled to enjoy their employer's preference, and to receive the due reward of superior merit. The agitation which has recently been so boldly set on foot to reduce all the workmen in a particular department of skilled labour to a common level, must have originated with some of those restless and pestilent spirits who are generally found to excel in the manufacture of frothy and violent speeches more than in patient and persevering

industry; and we are much mistaken if their ulterior views, however disguised for the present, are not the establishment of the system of Socialism in all its most levelling and debasing influences. We are at least assured of this that if the employers succumb to them in the present case, there will be no end to their demands; and we should not wonder, at no distant day, to find them asserting the principle that the employers, after paying for wages, materials, and all the other expenses necessary to the conducting of their business, should hand over the profits to their men. We only hope that the employers of engineers will severally adhere faithfully to their union so long as the operatives abide by theirs, for combination can only be resisted successfully by combination. If they become disunited, the Amalgamated Society will have an easy victory, and Socialism, in its inchoate form, at least, may be permanently established in England.

AMERICAN EXPERIMENTS WITH THE FIRE ANNIHILATOR.—EXCITEMENT.

Public notices were given that a grand experiment with the Fire Annihilator would be made on the 18th ult. at 61st-street, New York, at 1 P.M. The handbills and advertisements stated that a house would be set on fire, and all that had been claimed for the "Annihilator," by Mr. Barnum and others interested, would be confirmed by the annihilator extinguishing the flames and saving the burning house. It is well known to our readers that this invention has caused great excitement in our country, and that the company which owns the patent is composed of very wealthy and what are termed "big men." Determined to be on the first step of the ladder, we purchased a copy of the patent specification, got up engravings of the drawings, and published them. Having served as a fireman, and being not a little acquainted with the management of fires, also with the nature of the gases which extinguish flame, we took occasion, after a calm review of the matter, to say that we had no confidence in the general utility of the "fire annihilator." Our language was moderate, but decisive; nevertheless, being lovers of fair play, and being guided by the rule of honesty to confess wrong, when our error is demonstrated, we said in the article referred to, "We shall watch its progress and report its effects; if it proves all that some have said about it, we shall say so, when convinced by *ocular demonstration.*" We were on the ground before the appointed hour. The house built for the experiment was a small frame building 20 feet square, placed in a field on an elevated position. It was a rough board cottage, the main body of which was two stories high, and had a wing at each side. There was no bottom floor; the outside boards were placed vertically, with weather strips nailed on the seams. We were permitted to examine the building by the doorkeeper before it was set on fire. In the middle of the main part there were about a dozen 12-feet boards, some scantling, &c., set up vertically through a hole in the floor—the only floor—of the second story. Shavings were stuck around and between the boards, which were placed quite wide apart, and the roof inside was plastered with lime, and not yet dry. A crowd of police were there, and a chain was placed on stakes around the building, about ten feet from it. At half-past one o'clock, a gentleman came on the back roof, and requested all to retire outside, as Mr. Phillips was going to set the building on fire. It was proposed that a Committee should be appointed by the crowd to examine the building, witness the operation inside, and report. The Committee was appointed, and consisted of Alfred Carson, our Chief Engineer; R. B. Coleman, John P. Lacour, Zophar Mills, Moses O. Allen, and Mr. Eichell The following is their report:

First. The building was constructed of green spruce timber, and constructed in such a manner as would have been a difficult matter, under ordinary circumstances, to have got it fairly on fire.

Second. In our opinion Mr. Phillips had every opportunity afforded him to fairly test the experiment, and everything was in his favour.

Third. A slight fire was kindled inside the building, and the annihilator was almost instantly applied, before the fire got headway to any considerable extent—it partially extinguished it.

We would report further:—The wind was high and freezing, and if there was any virtue in the annihilators, and the experiment fairly conducted, the character of the "Annihilator" would have been established for ever. We counted twenty-one large annihilators, the price of each 35 dollars; if the shavings had been let alone, the fire would have gone out of itself, without the application of a single machine. The crowd, numbering thousands, was dissatisfied, numbers jumped over the chains, ascended the roof, entered the windows, and exposed to view the boards which had been set on fire and extinguished—they were not charred, some not coloured with smoke. They

then got a barrel of tar, piled up boards inside, and set the building truly on fire; for a long time this was difficult to do; we never saw boards so difficult to burn. When fairly on fire there was a good opportunity to try the effect of the annihilator. Not one was applied—the building burned to the ground. The crowd jeered and cheered, shouted "Humbug," and "Where's Barnum?" Mr. Phillips, we are told, commenced to apply the annihilator against the request of the Committee, who thought it was not then fairly on fire. We were told that eight annihilators were applied; we do not know how many were applied; we saw twenty-one full charged before the fire, besides a large box of charges, and sixteen empty after it. When we examined the building, we were satisfied that the experiment was not intended to be a fair one; two buckets of water could have done all the "annihilators" did; still, we felt for Mr. Phillips; he was no doubt pained and mortified at the result, but a New York populace could not be satisfied with what he did; and withal, if he had been a New York fireman, he would have managed his own invention much better.

We hope that none of our friends have lost anything by this invention; we early raised our warning voice, not that we were opposed to the owners or the invention, but because we deemed its scientific qualities of no practical utility for the purposes intended. The thousands assembled to witness the experiment, without perhaps a single exception, believed it to be an entire failure.

It was intended by the American Fire Annihilator Company to make a fine speculation out of it. The private circular of the Annihilator Company stated, "An end must be put at once to every serious conflagration in America;" it has not put an end to one; a poor wood-frame house put an end to twenty-one annihilators, at 35 dollars each—total cost 735 dollars; and two buckets of water, costing nothing, could have done as well. An agent for a machine was to have a profit of 66 3-8 per cent. "One of the great advantages of this invention," says the circular, "will be the immediate reduction it must occasion in the rates of insurance." We have not heard of this having been done in a single case. None would have rejoiced more than we had this invention been a genuine "Fire Annihilator."—*Scientific American.*

FIRE-ALARM TELEGRAPH.

The people of Boston are constructing a fire-alarm telegraph. Forty-nine miles of wire have been stretched over the city, diving under the arm of the sea which separates the main portion from South and East Boston. The first of the forty cast iron signal-boxes has been placed on the Reservoir in Hancock-street. These will be so distributed that every house in the city will be within fifty rods of one. Whenever a fire occurs, resort will be had to the nearest box, where, by turning a crank, instantaneous communication will be made to the central office, and from that—which stands related to the whole fire department of the city like the brain to the nervous system—instant knowledge will be communicated to the seven districts into which the city is divided, by so striking the alarm-bell simultaneously that the locality of the fire will be known exactly to all. This system, the perfect success of which is now certain, will stand forth as one of the finest achievements of scientific skill, and a source of just pride to Boston.—*Scientific American.*

MONSTER STEAM-BOAT.

The Washington correspondent of the *Atlas* (U. S.) says:—

"There is a drawing in the navy department, of a new steamboat which is about to be built in New York, for the Hudson River, and which is to make the trip from New York to Albany in five hours. She is intended to compete with the New York and Albany Railroad. By the kindness of Commodore Skinner, we obtained her proportions, which are as follows:—Length of keel 500 feet; length of deck, 350 feet. She looks like a sword-fish. There is 75 feet of keel at each end, extending out from the deck, which shows itself above water, and which is sharp and pointed like the sword of a sword-fish. Both ends of the boat are alike, and her engines are to work both ways. She is not intended to turn round, but to work like a ferry-boat. She is to be called the *George Washington*, and to have accommodation for three thousand passengers. She will make the passage of 150 miles in five hours. She has been designed and modelled by Mr. Davidson, of New York.

ON THE COMPARATIVE VELOCITY OF LIGHT THROUGH AIR AND WATER. BY MM. FIZEAU AND BREGUET.

(Translated from *Comptes Rendus*, June, 1850.)

We have applied ourselves to the solution of the question as proposed by M. Arago in 1848; that is to say, How can the two opposite theories regarding the nature of light

be submitted to a definite test? We have adopted such measures as are calculated to exhibit in a striking manner the differences of the phenomena as deduced from the one or the other theory.

As remarked in our preceding communication, the observation was made simultaneously on two bundles of light; the one having traversed the air, the other a column of water.

For each of these bundles the path was as follows:—A telescope was so disposed that its object glass was very near the rotating mirror; a little rectangular prism was placed in the focus of the telescope, in such a position that the solar rays falling upon it from a convenient lateral opening near the eye-glass, were totally reflected towards the object glass.

Beyond the rotating mirror, and at a distance which for the ray that passed through water amounted to two metres, there was a fixed reflector designed to send back the light to the rotating mirror by a normal reflection.

The focal distance of the telescope was such that the image of the little prism placed at its focus formed itself distinctly upon the fixed reflector just mentioned. After having been reflected from it, the light returned to the rotating mirror, was sent on through the telescope, and on passing the focus formed an image which exactly covered the prism.

By the rotation of the mirror we give birth to a number of images which succeed each other very rapidly, and the super-position of which produces the sensation of a permanent image.

When the rotation became sufficiently rapid, the permanent image was pushed forward in the direction of rotation, this deviation being the result of the angular motion of the mirror during the time occupied by the light in passing twice over the space which separated it from the fixed mirror.

A second similar fixed mirror was placed beside the former: it permitted us to make the experiment with air and water simultaneously.

If the lengths traversed had been equal for both media, the times occupied in passing them would be in the ratio of 4 : 3 or of 3 : 4, according to the one or other theory. and the deviations produced by the rotation of the mirror would have been in the same ratio.

Instead of equal lengths, we have adopted equivalent lengths; that is to say, lengths traversed by the light in equal times. These lengths are very different, according as they are calculated from the one or the other theory. The length for water being 1, the equivalent length for air would be $\frac{3}{4}$ by the theory of emission, and $\frac{4}{3}$ by the theory of undulation.

If the experiment be made by adopting the length $\frac{3}{4}$ for air, that of water being 1, according to the theory of emission, the times occupied by the two bundles of light in passing over these spaces will be equal, and consequently the deviations will be equal. By the other theory, on the contrary, the times occupied by the light in passing through both media, will be very different; these times will be for water and for air in the ratio of 16 to 9, and the deviations will be in the same ratio.

To coincide with the one or the other theory, it will therefore be sufficient to prove, either that the deviations are equal, or that one is nearly double the other.

If the equivalent lengths calculated from the theory of undulation be taken, the results will be similar, but inverse.

According to the theory of emission, the deviations will be in the ratio of 16 : 9; according to the other theory, they will be equal.

We have made these two experiments, and the results obtained are very exact. The phenomena observed are altogether in accordance with the theory of undulation, and in manifest opposition to the theory of emission.

In the first arrangement the deviation is greater for water than for air; it is nearly double. The difference is sensible with a velocity of 400 or 500 revolutions per second; with a velocity of 1,500 revolutions, it becomes quite evident.

In the second arrangement the deviation is the same for air and water; and whatever be the velocity of the mirror, there is no sensible difference between the two deviations. These experiments have been made in the meridian room of the Observatory; the column of water was two metres long, and was contained in a crystal tube closed at the ends with glass. This length is more convenient than that which we at first employed, namely, three metres. The light is less weakened, and, after its double passage, retains an intensity which may be estimated at double of that which was obtained with the tube of three metres.

The deviations were observed at a distance of 1·50 millim. from the rotating mirror.

AMERICAN REAPING MACHINES.

(From the American Patent-Office Report for 1850-51.)

Harvesters.—Under this division, fifteen patents have been granted. For the last two years much attention has been given to this class of agricultural machines. At first, they were confined to the cutting of grain chiefly, then to grain and grass, and now they have been extended to almost every herbaceous growth of the soil. Thus we have grain and grass harvesters, corn harvesters, cornstalk harvesters, cotton harvesters, cottonstalk harvesters, cloverhead harvesters, hemp harvesters, &c. I shall notice several of these, as they present something of interest to prairie farmers especially.

The first machine that I shall mention in this class, is a *machine to harvest cotton stalks* in the field. It is a machine having two horizontal shafts, running from side to side. The upper and forward one has radial knives or beaters, which rotate rapidly, and beat down the stalks, while the rear shaft is supplied with radial longitudinal knife-edges extending from side to side, and as the blades come down they chop the stalks in pieces.

The second machine noticed under this division, is a *grain and grass harvester*, presenting two principal points of invention. First, the cutters, which consists of two horizontal saw blades, lying flat upon each other, with the teeth looking forwards, and vibrating upon each other as the face of the saws is pushed forward against the standing grass. The peculiarity of these teeth consists in their being made concave on their inner faces, so that when they slide past each other, they cut somewhat on the scissors' principle, and are, to some extent, self-sharpening. Second, there are what are called cyma-reversa fingers, working in combination with certain rake-teeth, designed to hold the charge while the fingers take it and deposit it upon the ground.

The third machine of this division is a *corn stalk harvester*, the frame of which resembles a low three-wheeled truck, and bearing upon its upper surface, near its middle part, two broad metallic discs, armed with teeth on their peripheries, which teeth slightly overlap each other, and are capable of seizing and holding within their grasp any herbaceous matter, and, as the machine moves forward, to tear it up by the roots. The meeting of these teeth is near the central part of the machine, anterior to which the space is perfectly clear, so that when the machine is driven over a row of the corn stalks, the latter are successively brought against the teeth of the metallic discs, and drawn out of, and deposited upon the ground.

The fourth machine is an ingenious contrivance for distributing the cut grain of a harvester into suitable parcels for bundles, by the weight of the grain. It is called a *grain binder*. It consists of a self-regulating rotary cylinder, mounted on the rear end or extreme right side of the machine, and having its axle parallel with the rear end of the machine. This cylinder is supplied with catches and springs, and so arranged that when a certain weight of grain is received into one of its three compartments, it performs a third part of the revolution, and deposits the amount received for a bundle, while the next compartment of the cylinder is being charged for a second bundle, and so on.

One patent has been granted for a *machine to harvest hemp*, a prominent peculiarity of which consists in the method of severing the stalk, by means of an oblique chop stroke of the cutters falling obliquely across the spaces between the fingers, and upon the edge of the finger on the further extremity of the finger space; the oblique stroke being given by the shaft on which all the cutters are arranged, which shaft is semi-rotated in screw-thread bearings, so that the shaft in so rotating and re-rotating as to raise and depress the cutters, should, in performing this operation, give the oblique motion which severs the stalk, as set forth.

Two machines, adapted to harvest maize, have been patented. The first of these contains a thresher to husk and shell the grain. The harvester consists of a machine, in its general arrangement not unlike a clover-head harvester. But it has a series of pairs of rollers, one pair between every pair of teeth, to seize the stalks and pull them downwards, until the ear is drawn against the tops of the fingers by which the ear is severed from the stalk. The ear then rolls down an inclined plane to the thresher. A *second machine for harvesting maize or grain* has also been patented. The gist of this invention consists in the construction of the grain reel, made with rows of fingers, projecting radially, and rotating over or through the standing grain. The stalks being received between the fingers, the ears are pulled off and deposited on an inclined endless apron.

A Grass Harvester of a novel construction has been patented, which it will be difficult to describe without the aid of drawings. Some idea of its general character, however, may be formed, by supposing a flat washer-like ring of metal to be cut out of a sheet of metal, and placing it in a hori-

zontal position. Now place upon its surface, symmetrically, a series of sharp razor blades, a few inches apart, having the shank confined to the ring by a screw or rivet, and the ends of the blades projecting beyond the periphery of the ring. If now the ring be rotated, so that the cutting faces of the blades be forward, and in this state be brought against the standing grass, it is contended by the inventor that the machine will be a successful instrument. The cutting blades are supported in their position by suitable contrivances, and the ring with its cutters has also suitable devices for supporting it, and rotating it as the carriage moves forward, which it is unnecessary to refer to here.

Horse Rakes.—Only one apparatus under this division is regarded worthy of special notice, although six patents have been granted.

This invention is denominated *a machine for binding grain.* The frame of it resembles the platform of an ordinary harvester, so constructed that the curved rake teeth, projecting upward through the floor, and passing across the same from side to side, collect the grain at the opposite side, where it is brought against a curved arm, between which arm and teeth the grain is pressed, and at the same moment another curved figure rises through the floor from behind, to support that half of the bundle, while at the same time, the curved rake-teeth, by means of the machinery, fall backward through the floor, and are carried back to the opposite side of the platform, or to the starting-place, for a new charge.

The only duty required of the attendant with the machine, is to tie the band for each bundle or sheaf.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING JANUARY 5, 1852.

FREDERICK ROSENBORG, of the Albany, Esq. *For improvements in the manufacture of casks, barrels, and other like articles, and the machinery employed therein.* Patent dated July 5, 1851.

HENRY CRAVEN BAILDON, of Edinburgh, chemist. *For improvements in writing, printing, or marking letters, characters, or figures upon paper, parchment, or other materials properly prepared for that purpose.* Patent dated July 7, 1851.

The object of this invention is to guard against the falsification of banker's cheques, letters of credit, and other similar documents; and for this purpose the patentee makes use of coloured paper, and produces letters or marks thereon by means of a chemical fluid capable of discharging or changing the colour of the paper or other material to which it may be employed. In order to afford additional security, the patentee prefers to use, for preparing his paper, a compound colour, such as purple or green, which may be made, the purple with prussian blue and an animal, mineral or vegetable red, and the green, with Prussian blue and chromate of lead. The fluids employed for marking or writing, are solutions of potash (liquor potassæ) and of soda, both of which are capable of discharging colours produced as above mentioned. Some of the paper sold by stationers is coloured with Prussian blue, and such paper may be also used for the purposes of the invention; and if paper be prepared with iron, a solution of ferrocyanide of potassium, with a small quantity of muriatic acid, will be suitable for writing thereon. The different colouring matters employed in the preparation of paper may be mixed with the pulp in the course of manufacture, or the paper may be prepared by immersion in the different solutions, and then dried, and if necessary, pressed. Parchment is prepared by immersing it, when strained on a board or frame to prevent warping, in colouring solutions; and if a green colour is desired, it may be obtained by the use of Prussian blue and solution of fustic.

When printing with alkaline solutions on paper prepared by the above-mentioned processes, the types are to be slightly oiled on the sides to prevent the solution running, and a gutta-percha covered roller is employed for distributing the solution over the type. Instead of using solutions for discharging the colour from tinted paper, coloured solutions may also be used, so as to vary the colour of the parts of the paper to which they are applied; and if desired, portions of documents may be printed or written by the means above mentioned, and other portions printed or written with common printing or writing inks.

Claims.—1. The mode of writing, printing, or marking the letters, characters, or figures of documents upon coloured paper, parchment, or other proper material, by means of such a chemical fluid or mixture, as will discharge or change the colour of those parts of the paper, or other material so written or printed on or marked.

2. The mode of writing, printing, or marking the letters, characters, or figures of documents upon coloured paper, parchment, or other proper material, by means of such a chemical fluid or mixture as aforesaid, such fluid or mixture being also coloured or tinted, so as to colour or vary the colour of those parts of the paper or other material to which it may be applied.

3. The writing, printing, or marking a portion or portions of the letters, characters, or figures of documents upon coloured paper, parchment, or other proper material, by means of such a chemical fluid or mixture as aforesaid; and also writing, printing, or marking another portion or other portions of such letters, characters, or figures, in any ordinary manner, with writing ink or printing ink.

JAMES BUCHANAN MIRRLEES, of Glasgow, engineer. *For certain improvements in machinery, apparatus, or means for the manufacture or production of sugar.* Patent dated July 7, 1851.

Mr. Mirrlees describes an arrangement of sugar-mill, for the purpose of expressing the juice from the cane. The peculiar features of novelty are, that the engine and mill are combined in the same framework, which is of malleable iron, and made sufficiently elevated to serve instead of shears or triangles, for the purpose of raising the rollers and heavy work of the mill into their places. The base plate on to which the expressed juice falls, is made hollow, and the cylinder of the engine is placed at such a level, and in such a position, as to admit of the waste steam passing direct into the hollow base plate for the purpose of heating the juice on its way to the boiling-pan; or instead of employing the waste steam for this purpose, other steam or hot air may be used, and caused to circulate through the base plate.

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Cook, of Kingston-upon-Hull, working copper-smith, for certain improvements in the construction of steam engines, consisting of a rotatory circular valve for the regular admission of steam from the boiler alternately into the chambers of the two cylinders of double-acting engines. January 12; six months.

Alcide Marcellin Duthoit, of Paris, France, statuary, for an improved chemical combination of certain agents for obtaining a new plastic product. January 12; six months.

Robert John Smith, of Islington, Middlesex, gentleman, for certain improvements in machinery or apparatus for steering ships and other vessels. January 13; six months.

Jean Antoine Farina, of Paris, proprietor, for a process for manufacturing paper. January 13; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Jan. 10	3077	Walsh and Brierley	Halifax	Double bar brace-slide.
12	3078	J. and T. Brown	Bradford	Pressing lever.
,,	3079	T. Johnson	Manchester	Compound spring for a printing-press.
,,	3080	G. Lewis	Leicester	Lock.
13	3081	W. Pearse	Tavistock	Roasting-jack.
,,	3082	R. Gordon & J. Thompson	Stockport and Manchester	Hollow wrought-iron yarn-beam, back-roller, and cloth-beam.
14	3083	S. Samuel	Houndsditch	Cap-peak.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

Jan. 15	347	H. de Beaufort	Great Ryder-street	Measuring indicator.

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Edited by J. C. Robertson, 166, Fleet-street.

THE CHATTERTON PADDLE-WHEEL.

Fig. 2.

Fig. 1.

THE CHATTERTON PADDLE-WHEEL.

THE engravings on our first page represent a paddle-wheel of a new construction, invented by Mr. Richard Chatterton, of Cobourg, in Upper Canada, with which a trial of a rather remarkable character was made on the Thames on Saturday last. We shall first describe this wheel, and then record the results of the trial made with it, of which we had the pleasure to be eye-witnesses.

Figs. 1 and 2 represent respectively edge and perspective views of this propeller. The distinction between this and the ordinary wheels is, that the floats of the former paddles enter and leave the water horizontally, and at intervals, with violent successive concussion, and consequent disadvantage of downward pressure, attended with a great deal of unpleasant vibration and back lift, while in the latter they pass into and emerge from the sphere of resistance quietly and continuously, much after the manner of a screw, without disturbing in front or lifting the water behind, being at the same time perfectly balanced at all points, as shown by the shading in the figures, half of each float being precisely opposite a corresponding half on the other side, and each pair acting, as it were, like a wedge in passing through the water. The pressure on the shaft is thus quite as square as in the common wheel, while the displacement being the same, with a larger surface of friction exposed to the surrounding water, the propelling effect below is proportionately increased, on the well-known principle that a body wedge-shaped offers greater resistance in its transit through water with the point of the wedge foremost, than it would do if reversed, because it is more easily drawn from, than driven against, the friction on its sides. Again, the water thrown abaft the wheel, as it emerges, falls under the run of the vessel, helping to fill up the vacuum and urge her forward The propeller has also, obviously, the further advantage of working much easier for the engine in a heavy sea, particularly a following sea, than the long square float; while in tideways, or in ascending rapid currents, the continuity of its action must prove equally beneficial.

The Thames Iron Steam-boat Company having resolved to give Mr. Chatterton's invention a trial, caused a wheel on his plan to be fitted to one of their boats, well known on the river by the name of the *Bridegroom*, and that its capabilities should be tested by running the *Bridegroom* from Cadogan-pier, Chelsea, to and through London-bridge and back, against the best of their other boats, the *Twilight*, which had been recently fitted with a new paddle-wheel with zig-zag floats, invented by Mr. J. L. Stevens, and patented November 27, 1851. But previous to this trial, it was thought only fair—and it obviously was so—that it should first be ascertained what amount of advantage had been achieved in the *Twilight* over the common paddle-wheel by the substitution of Mr. Stevens's. The *Bridegroom* and *Twilight* are vessels of nearly the same build, tonnage, and steam power—the only material difference between them being, that the one has a keel and the other none; and, previous to the alteration in the *Twilight's* paddles, they were, in point of speed, as nearly as may be on a par.

The result of the preliminary comparison thus instituted between the two vessels established very clearly that the *Twilight* had been improved in speed by the adoption of Mr. Stevens's paddle to the extent of about 10 per cent., or upwards, of a mile in every ten.

We come now to the trip of Saturday last, between the *Twilight* as thus improved and the *Bridegroom*, fitted with Mr. Chatterton's propeller. The vessels made a very fair start together from Cadogan-pier, and soon a most exciting struggle ensued between them—the vessels alternately heading each other, then running neck and neck, and occasionally "hugging" each other, after a manner more affectionate and sisterly than convenient or agreeable. Part close-company they could not, or would not, and to the starting-point they returned without an inch of distance between them. The race was pronounced, in sporting phraseology, to be a dead heat.

Each party, as is usual in boat contests, insists on a variety of minor circumstances as having effected the ultimate result; but, for our own parts, we must say that we thought the trial, upon the whole, perfectly fair.

It results from it, that since the *Twilight*, with Mr. Stevens's wheel has been proved superior in point of speed to the common wheel in the proportion of 10 per cent: so must the *Bridegroom* also, which is fitted with the Chatterton propeller.

One thing was noticed on board the *Bridegroom*, which is particularly deserving of attention, and that was the almost entire absence of vibration, furnishing strong evdeince of the ease with which the floats of the Chatterton wheel enter and emerge from the water.

After the race had been concluded, several short trials in *backing* were made between the vessels, when the *Bridegroom* exhibited a decided superiority in that respect over the other; and this we take to be another proof of the equability of the action of the Chatterton wheel, for it could only have been from a greater interference with the water of the rudder, in the case of the *Twilight*, that she did not back so well as she advanced.

Copy of a Letter from the Chairman of the London, Westminster, and Vauxhall Steam-boat Company to Mr. Chatterton.

Angel-court, Jan. 22, 1852.

Sir,—As Chairman of the Directors of the London, Westminster, and Vauxhall Steam-packet Company, I have much pleasure in forwarding to you, on their behalf, the following testimoni l of the merits and performance of your new paddle-wheel, which has been applied under your direction, but at the Company's expense, to their steam-boat the *Bridegroom*.

The boat is now plying on the river, and, from a comparison of her speed as opposed to her performance with the common wheel, I am enabled to say that she is now decidedly faster than she was before, and that the unpleasant vibration produced in all cases by the common wheel, and more or less even with the feathering paddle, has been very considerably, if not wholly removed.

I have no doubt that your wheel must, particularly on ocean steamers, be a great improvement in steam navigation, while, from the absence of vibration, the boats themselves will certainly be more durable.

With every wish for the success of your wheel which it deserves,

I am, Sir, yours, &c.,
LEWIS H. HASLEWOOD.

PIECE-WORK AND OVERTIME.—THE "CASE IN POINT."

Last *Sunday Times* inserted as "A Case in Point" part of the note, p. 28, of the *Mechanics' Magazine* of the preceding day, but without specifying the "point" to which the case of the founder was particularly applicable. That note had been penned and sent for insertion in the Magazine before the writer was aware of the existing struggle between the employers and the employed in the engineering business; but it does happen to afford a "case in point," exhibiting the one-sided views taken by the objectors to piece-work and over-time. Their great plea for the abolition of both is that mechanics should be allowed time for recreation, and for the acquirement of knowledge—but they do not state of what use knowledge can be to the operative, if he be debarred from profiting by his acquirements, as he would be were piece-work abolished. It is by piece-work only that a man can obtain adequate remuneration for superior skill. In the "case in point" it was by very superior skill, and by that alone, that a founder was enabled justly to obtain the great earnings of two or three-and-twenty shillings a day. Take away pecuniary reward for operative skill, what motive will remain for acquiring it? In the other point of view brought forward by the Amalgamated Society as a reason for their demands—that of affording leisure to the operative—in what way can a man's exertions enable him to obtain a competency with so much time at his own disposal as by piece-work? The founder who earned the great wages above-mentioned, could, on comparison with others of his craft, have afforded to spend, say four whole days out of the working six in recreation, or in the furtherance of his acquirements. That particular founder's future is not remembered, if ever known, but a general result in the three Portsmouth establishments was that the operatives who distinguished themselves by superior skill joined to superior industry, obtained either promotion in the yard, even to that of master-millwright, or, if they preferred quitting it, advantageous engagements elsewhere; and how many are there of the greatest engineers the country boasts of, who were themselves

operatives? The few hundred men employed in Sir Samuel Bentham's three establishments in Portsmouth Dockyard, bear but a trifling proportion to the operatives of a similar description for whom there is employment in Great Britain; but the same principles that insured success to both the employer and the employed at Portsmouth are equally applicable to the most extensive manufactories throughout the country.

As to the grievance of working overtime, an habitual practice of the kind is certainly repugnant to the kindly feelings of man towards man. Habitual work beyond the strength and endurance of men is known to destroy health, and almost certainly to bring on prematurely the decrepitude of old age. Ten hours of work per day has been very generally esteemed to be the amount of labour which at a *regular* calling, man's constitution is able to endure. A *regular* calling is specified, because, where work is varied, the change from one kind of labour to another prolongs the powers of exertion; thus domestic servants find no hardship in being employed, meal-times excepted, from seven in the morning to eleven at night; so, many shipwrights who had laboured hard at ship-building in Portsmouth Dockyard from six to six, would afterwards dig for an hour or two in their little gardens. Still ten working hours may be considered as the reasonable limit of a day's work for the average of men. Sir Samuel Bentham, convinced of this, fixed on ten as the working hours in his three establishments. In no manufactory does the uncertainty of demand for labour exist in a greater degree than, during war-time, in a Royal dockyard at such a port as Portsmouth; he had to provide for this, and did so by permitting, in cases of extraordinary pressure, two hours of additional work—beyond that addition, *never;* but when those factories were incompetent by limited day-work to supply demands, then *continuous* work was effected by means of relays of operatives.

This leads to the observation, that no inconsiderable part of the cost of fabrication of machines is that of the *interest* on sunk capital, yet that this has not been noticed on either side during the present unfortunate dispute, much as it might be thought to influence masters in a desire to work their plant over-time. Sir Samuel was as sincerely the operative's friend, as he was a conscientious servant to the public—he could not for the operative's sake institute night-work as then practised; on the other hand, for the public interest, he could not allow the capital sunk in works to be dead for half their available use; he sought to reconcile these two discordancies, and succeeded. His very simple expedient was that of causing the relay of hands to take place at dinner-time, instead of, as was customary, in the evening; by this contrivance, each relay of operatives had a part of every night for rest during the natural time for sleep, and by some minor arrangements work went on instead of ceased, for an hour at dinner time. The Amalgamated Society profess that they would be content with eight hours of work (if they be honest, at a proportionate reduction of pay) so that employment could thereby be afforded to a greater number of engineers. If this be the Society's real sentiment, it might be gratified by the introduction of two sets of hands instead of one, each of them working eight hours; by such an arrangement the whole plant of a manufactory might be made productive for 16 hours of the 24, to the great reduction of cost in fabrication, and leaving 16 hours of the 24 to every operative for rest, for recreation, or for mental improvement, as might best please every individual of them.

There can be but few first-class engineering manufactories where buildings and machinery have cost less than 50,000*l.*, and six per cent. on a capital so sunk is as little as can be reckoned for interest of the money, and chance of disuse of the plant; that six per cent. amounts to 3,000*l.* per annum; therefore were the plant put to use for a third more than the usual time, a saving would be effected of no less than 1,000*l.* a year. Supposing this to be wholly absorbed by the proprietor, it would of itself afford a tolerable profit, but the probability is, that were such a saving produced, it would be but in part taken as profit, while a part would go to a diminution of the sale price of articles manufactured, and a part in some way to the benefit of operatives employed.

If the Amalgamated Society be sincere in disclaiming an intention of requiring

to be paid as much for eight hours' work as for ten, and if their sole object is to obtain work for their now unemployed brethren, the Society could not object were some such arrangement as the above to be come to by their employers.

Equalization of wages is another aim of the Society. This, in respect to shipwrights, is the practice in the Royal dockyards; and to this vicious mode of payment the nation is indebted for no small portion of the sum it has to pay for ship-work. In those establishments the young and strong, the old and the infirm, the diligent, the idle, the skilful, the unskilled—all, be they but shipwrights, are paid the same for a day's work, be it much that a man performs, be it little, be it good, be it bad. Is such an equalization of wages likely to, or does it induce industry, or encourage skill? The attempt to limit the number of apprentices is, in point of fact, an endeavour to impose on masters the necessity of employing idle, half-skilled workmen, since by limitation as to numbers, such must be engaged if better are not to be had. Is this a fair proceeding towards the really skilled, the really conscientious and industrious workman?

What would be the fate of our cotton-mills and cotton trade were all women and children operatives dismissed, and in their lieu were regularly apprenticed machine-makers, the only hands employed for tending the machinery? Ruin—utter ruin. Precisely the same it is, in regard to a planing or a boring engine: the mechanist has invented, and has made it exactly in the same view as he has invented and made the machinery in a cotton-mill—that is, to enable unskilled hands to perform operations which theretofore required skill. Do away with employing unskilled hands to tend machinery at little cost, and the great demand for machines themselves will cease, and then what employment would remain for machine-makers?

The Amalgamated Society say that they have capital at command, and that they will set up for themselves. But it is neither abundance of capital nor abundance of skilled hands that can suffice for the immediate cheap fabrication of machinery. Master manufacturers are possessed of a great number of machines for facilitating their work, and without which it could not be produced but at an enormously increased price. True there is nothing—some patents excepted—to prevent the Amalgamated Society from making all kinds of machines; but their manufacture requires time, and before those necessary in the fabrication of general machinery could be completed, our great export trade in this branch of manufacture will most probably come to an untimely end. If some of our continental neighbours be a little too self-sufficient to adopt other people's practices, it is not so with the rapidly-advancing States across the Atlantic. Our cousins there are quick-sighted, enterprising, have a ready perception of the useful, and, above all, never disdain to imitate the inventions of other countries; nor do they reject innovations because contrary to established usage—the great bane to many an improvement amongst ourselves; customs of trades, for example, which, amongst mill-wrights, "forbad a labourer to turn their grindstones for them." The present proceedings of the Amalgamated Society may bring ruin on its members, on their masters too, but it is the nation at large that will be the permanent sufferer. Our staple trade in machines, it must be feared, will be driven from us, never to return. M. S. B.

January 15, 1852.

ENGINEERS' LABOURERS.

Sir,—Observing, amongst other things, that the Amalgamated Society of Engineers demand the dismissal of all those persons who are employed upon planing and other machines used in the construction of steam engines and machinery for general purposes, I beg leave, through your columns, to state the reason why this class of men were introduced into the workshops. In the year 1829, Mr. Roberts, of the late firm of Sharp, Roberts, and Co., brought out his invention of the Key-groove Engine (or, as some call it, the Slotting Machine.) At that time I was a workman in the employ of the above-named gentlemen, and Mr. Roberts requested me to fit into that machine the necessary tools, and set it to work. I did so, and continued to work the machine for several weeks, until he told me he required my services in another part of the works; but he said I was to select a "filer" to take charge of the machine and work it. I spoke to some of my shopmates, and it was arranged that John Bottomley should

take my place, which he did; but during the time this was going on, several of the workmen were exclaiming—"Oh! it is only a *labourer's* job;" and this, coupled with the fact that Bottomley (who was a good workman) was anxious to return to the vice to work "piece-work," led to his declining to work the machine any longer. It was then decided to select a "turner" to fill the situation, and Samuel Butcher consented to take the place of Bottomley; but he also refused to remain at the machine, it being considered *by the workmen* more suitable for a labourer; and, of course, one was appointed to the machine,—and this class of men have continued to work these machines to this day. The planing machine was in operation years before this key-groove engine, and the history of its attendants is quite analogous to the other, and therefore I need not go further into detail concerning it; but I cannot refrain from appealing to all right-minded workmen on the injustice and sinfulness of a demand which, if conceded, would inflict a vast amount of suffering upon a deserving class of operatives, many of whom I have known for nearly the last twenty years, and who were young men when placed in their present situations; they have since got married, and have families depending upon them for support; and to talk of "*turning them out*" of those places which formerly the parties themselves refused to fill, is, to my mind, an act of the greatest oppression and cruelty. I know numbers of men amongst the engineers and machinists who, I venture to say, would never be parties to such an unreasonable demand; and I hope the perusal of this letter will lead them to make known their sentiments, and wipe off a stain from their character as a body, which certainly at present attaches to them.

I have been induced to make this communication having been an eye-witness of the facts stated, and feeling it to be my duty to place the matter fairly before the public, as an act of justice on behalf of a deserving class of men.

I am, Sir, yours, &c.,

BENJ. FOTHERGILL,
Consulting Engineer.

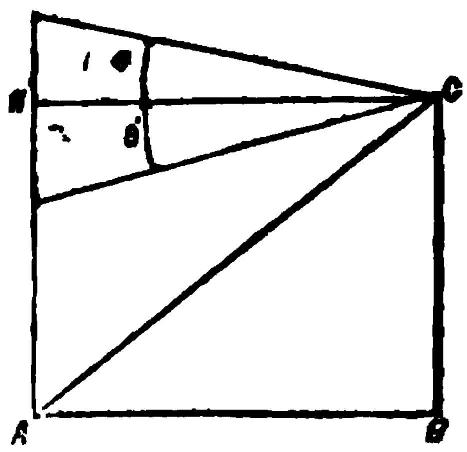
Ducie-buildings, Manchester,
Jan. 20, 1852.

ON THE MOTION OF A BODY ON AN INCLINED PLANE, WHEN THE FRICTION IS GIVEN. BY THOMAS TATE, F.R.A.S., AUTHOR OF "A TREATISE ON THE STRENGTH OF MATERIALS," ETC.

1. PROP.—*To find the velocity gained or lost by a body moving on an inclined plane,* ABC, *whose coefficient of friction is given.*

Let w = the weight of the body; v_1 = the velocity with which it is projected up or down the plane; v = the velocity of the body after it has moved over the

Fig. 1.



space AC; f = the coefficient of friction; θ = the angle of friction; U = the work due to friction in moving the body through the space AC; U_1 = the work due to gravity; and u = the work accumulated in the body, that is, the work gained or lost, as the case may be; then

$$u = \pm U_1 - U,$$

where the + or − sign is taken according as the body is projected down or up the plane.

Now

$$u = \frac{w(v^2 - v_1^2)}{2g}; \; U = f.w.AB; \; U_1 = w.BC;$$

hence we have by substitution, &c.,

$$\frac{v^2 - v_1^2}{2g} = \pm BC - f.AB$$

$$= \pm BC - \tan.\theta.\ AB.$$

In order to give a geometrical interpretation to this result; draw CH parallel to AB, and AH to BC; also draw CK and CK_1 making the angles HCK and HCK_1 respectively equal to θ the angle of friction; then HK or HK_1 = tan. θ. AB.

Let the body be projected down the plane; then

$$\frac{v^2 - v_1^2}{2g} = BC - \tan.\theta.\ AB$$

$$= BC - HK$$

$$= AK \ldots (1),$$

that is to say, *the velocity gained by the body in descending from* C *to* A *is equal to the velocity which it would acquire in falling freely through* AK.

Let the body be projected up the plane; then

$$\frac{v_1^2-v^2}{2g}=\text{BC}+\tan.\theta.\text{AB}$$
$$=\text{BC}+\text{HK}_1$$
$$=\text{AK}_1\ldots(2),$$

that is to say, *the velocity lost by the body in ascending from* A *to* C *is equal to the velocity which it would lose in ascending freely through* AK_1.

Cor. 1. When the angle of friction is equal to 0, then the velocity gained or lost is simply due to AH, the vertical height of the plane, which is a well-known dynamical theorem.

Cor. 2. If the inclination of the plane be equal to the angle of friction; then HK=BC, and AK=0, and therefore, in this case, the body will move *uniformly* down the plane with the velocity of projection.

2. Prop.—*To find the point to which a body will ascend an inclined plane,* ABC, *when the velocity of projection is given.*

Take the vertical AK_1 to represent the height from which a body must fall in order to acquire the given velocity of projection; draw K_1C, cutting the plane in C, and making the angle AK_1C equal to the complement of the angle of friction; then C will be the point to which the body will ascend.

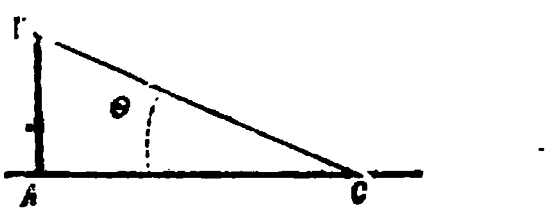
For in this case, from eq. (2), we have

$$v=0, \text{ and } \frac{v_1^2}{2g}=\text{AK}_1.$$

Cor. 1.—*When the plane* AC *is horizontal.*

Take the vertical AK to represent the height from which the body must fall to acquire the velocity which it has at A; draw KC, cutting the horizontal

Fig. 2.

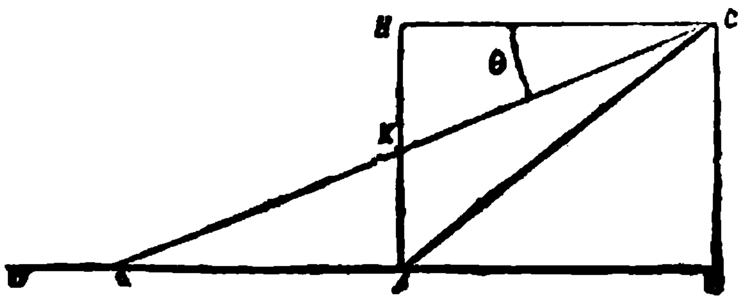


plane in C, and making the angle AKC equal to the complement of the angle of friction; then C will be the point at which the body will come to a state of rest.

3. Prop. *To find the distance,* AQ, *which a body will move over, on the horizontal plane* AD, *after descending the inclined plane* AC.

Draw CK, as in Art. 1, making the angle HCK equal to the angle of friction; produce CK until it intersects AD in Q; then AQ will be the space which the body will move over before it comes to a state of rest.

Fig. 3.

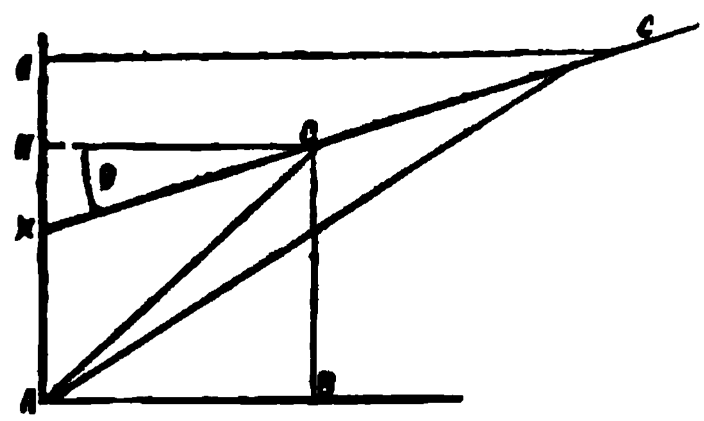


For AK will be the vertical height due to the velocity acquired in falling down AC, and since ∠AQC=∠HCK, therefore by Cor. 1, Art. 2, Q will be the point at which the body will come to a state of rest.

4. Prop. *To find the locus of the planes of equal velocities.*

Let the vertical AK represent the height from which a body must fall to acquire the given velocity; draw KCC_1 making, with the horizontal line CH,

Fig. 4.



the angle KCH equal to the angle of friction; then KCC_1, &c., will be the locus of the extremities of the planes AC, AC_1, &c., of equal velocities, that is to say, the velocities acquired by a body descending these planes will be equal to the velocity acquired by a body in falling freely through AK.

From C_1 draw C_1H_1 parallel to CH; then by Art. 1, the velocity acquired in descending the plane AC_1, or the plane

AC, is equal to the velocity which would be acquired in falling freely through AK; and the same may be shown to hold true for any other plane drawn from A to meet the straight line KCC_1.

5. PROP. *To find the time of a body's motion on an inclined plane, the coefficient of friction being given.*

Let g_1 = the accelerating force acting down the inclined plane ABC, see fig. 1; p = the moving pressure; t = the time in descending the space AC; $a = \angle BAC$ the inclination of the plane; then

$$AC = t^2 \times \frac{g_1}{2},$$

$$\text{but } p = w.\ \sin a - f.\ w.\ \cos a,$$

$$\text{and } g_1 = \frac{p}{w}.\ g = g\ (\sin a - f.\ \cos a),$$

therefore, by substitution and reducing, we get

$$AC = t^2 \times \frac{g}{2}\ (\sin a - f.\ \cos a)\ ..(3),$$

$$\therefore\ t = \sqrt{\frac{2\ AC}{g} \cdot \frac{1}{\sin a - f.\ \cos a}}.$$

$$= \sqrt{\frac{2\ AC}{g} \cdot \frac{\cos\theta}{\sin(a-\theta)}}\ ..(4),$$

by substituting $\tan\theta$ for f, and reducing.

If $\theta = 0$, then

$$t = \sqrt{\frac{2\ AC}{g \sin a}}\ ...(5).$$

If the body be projected up the plane with the velocity v, to find the time t at which it will come to a state of rest. In this case,

$$g_1 = g\ (\sin a + f.\ \cos a),$$

$$\therefore\ t = \frac{v}{g_1} = \frac{v}{g} \cdot \frac{1}{\sin a + f.\ \cos a}$$

$$= \frac{v}{g} \cdot \frac{\cos\theta}{\sin(a+\theta)}\ ...(6)$$

where $\frac{v}{g}$ is the time in which the motion would be destroyed if gravity were acting freely on the body.

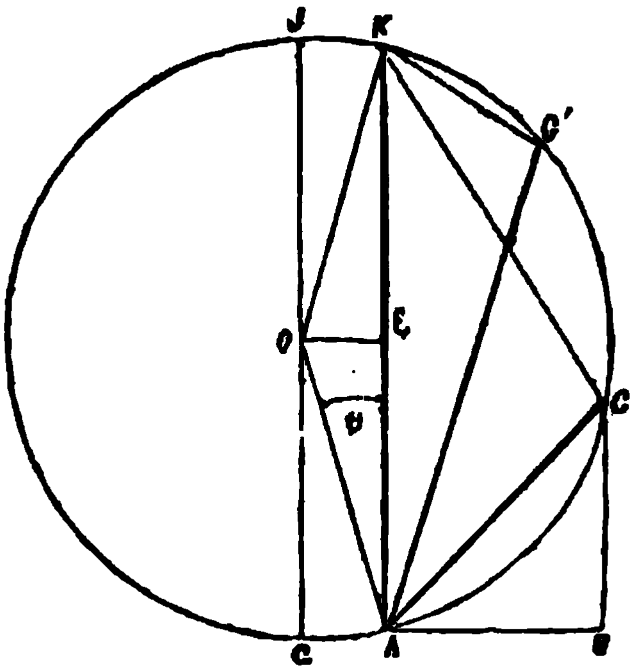
If the body be projected on the horizontal plane, then $a = 0$, and

$$t = \frac{v}{g} \cdot \frac{1}{\tan\theta} = \frac{v}{g} \cdot \frac{1}{f}\ ...(7).$$

6. PROP. *To find the locus of the planes of equal times of descent, the coefficient of friction being given.*

Let AC, AC_1, &c., be the planes down which a body will descend in equal times. Take the vertical AK ($=2a$) to represent the space through which the body will fall in the given time t; and let $AB = x$, $BC = y$, be the co ordinates of C; then we have from eq. (3) Art. 5,

Fig. 5.



$$AC^2 = t^2 \times \frac{g}{2}(AC \sin a - f.\ AC \cos a)$$

$$= t^2 \times \frac{g}{2}(BC - f.\ AB).$$

Now AK is the space through which the body will fall in the time t, therefore $AK = t^2 \times \frac{g}{2}$; and from the right-angled triangle ABC, we also have $AC^2 = AB^2 + BC^2$; hence we find by substitution

$$AB^2 + BC^2 = AK\ (BC - f.\ AB),$$

$$\therefore\ x^2 + y^2 = 2ay - 2fax,$$

substituting $y + a$ for y, and $x - fa$ for x, in order to eliminate the first powers of x and y, we get

$$x^2 + y^2 = a^2 + f^2a^2,$$

which is the equation of a circle, whose radius is equal to $a\sqrt{1+f^2}$.

Let O be the centre of the circle; draw the vertical GOJ and let fall OE perpendicular to AK; then

$$OA^2 = a^2 + f^2a^2,$$

$$= AE^2 + AE^2 \tan^2\theta;$$

$$\therefore\ OE = AE \tan\theta;$$

$$\therefore\ \tan\theta = \frac{OE}{AE},$$

$$\therefore\ \angle KAO = \theta,$$

hence it follows that *the locus of the planes of equal times of descent, is an arc of a circle whose chord is AK, making with the radius OA an angle KAO equal to the angle of friction.*

In like manner it may be shown that KC, KC_1, &c., are planes of equal times of descent.

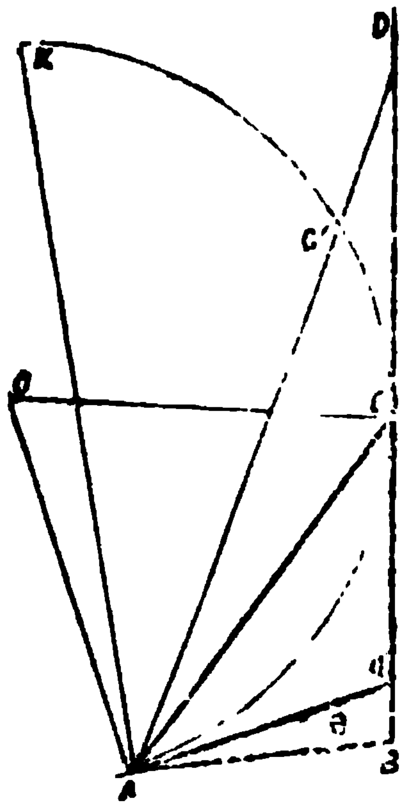
COR. 1. If the planes be perfectly smooth, then $\theta = 0$, and AK becomes the diameter of the circle, which is a well known dynamical theorem.

7. PROP. To find the plane, AC, of quickest descent, which can be drawn from a given point A to meet a given plane BD.

Let AB be a horizontal line. From A draw AQ, making the angle BAQ equal to the angle of friction; from Q take QC equal to QA; and join AC; then AC will be the plane of quickest descent.

Draw CO perpendicular to BD, and AO to AQ; then O will be centre of a circle, ACK, touching the lines BD and AQ in the points C and A. Draw the vertical AK, and join AD cutting the circle in C^1; then $\angle OAQ = \angle KAB$

Fig. 6.



and $\therefore$ $\angle KAO = \angle OAQ =$ the angle of riction; hence it follows, Art. 6, that the times of descent down the chords AC, AC_1, &c., will be equal; therefore the time of descent down AC must be less than it will be down AD, or any other line that can be drawn from A to meet the given plane BD.

COR. 1. If the plane be perfectly smooth, then $QB = 0$, and therefore $\angle BAC = \angle BCA$.

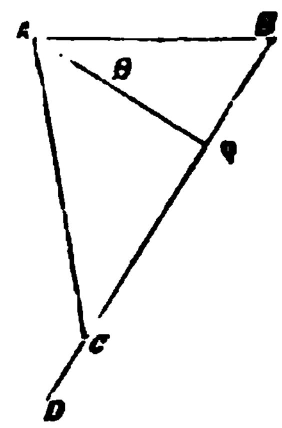
COR. 2. If the plane BD be vertical, and the angle of friction equal to nothnig; then the plane AC will make with the horizon an angle of 45°. In order, therefore, to secure the most rapid descent of water, &c., from roofs, &c. the pitch should exceed 45°.

COR. 3. In the foregoing investigation, the given point, A, is assumed to be at the foot of the plane; but if the given point be assumed to be at the top of the plane, then the line AQ is drawn as in fig. 7.

PROP. 8. *To determine the work in moving a body up any curved surface by a pressure always acting parallel to the direction of that surface.*

Let ABC be an inclined plane (see fig. 1); then the pressure on the plane $= w \cdot \dfrac{AB}{AC}$; $\therefore$ work due to friction in

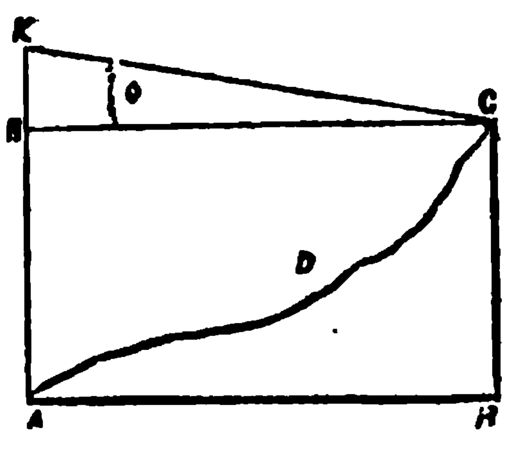
Fig. 7.



movin*g* he body from A to $C = f.w$; $\dfrac{AB}{AC} \times AC = f.w.AB$; and work due to gravity $w.BC$; $\therefore$ total wor $= w(BC + AB)$.

Now this expression is independent of the length of the plane, it being, in fact, the work expended in elevating the body through the vertical height BC, added to the work done in moving the body over the horizontal distance AB. As a curved surface may be regarded as

Fig. 8.



being made up of an indefinite number of straight planes, therefore the work upon the whole curve will be equal to the work done in opposition to gravity, added to the work done upon the hori-

zontal projection of the curve in opposition to friction. Thus we have—

Work in moving the body up the curved surface ADC $= w(BC + f \,.\, AB) = w(BC + \tan.\theta \,.\, AB)$.

In order to give a geometrical interpretation to this result: draw CH parallel to AB, and AH to BC; also draw CK making the angle HCK equal to θ the angle of friction; then $HK = \tan.\theta \,.\, AB$; and therefore we get,—the work in moving the body up the curved surface ABC $= w(BC + HK) = w \times AK$, that is to say, *the work in moving a body up any curved surface ADC is equal to the work in raising the body through the vertical height AK in opposition to gravity.*

THE LOSS OF THE "AMAZON."—MODE OF STOPPING STEAM-ENGINES FROM THE QUARTER-DECK.

Under the prevailing excitement occasioned by the disaster, so fresh in the minds of every one, I may be forgiven if I offer a suggestion of a simple arrangement, which had it existed on board the *Amazon*, and had been taken advantage of, there is not a shadow of doubt but probably all, or, at all events, the majority of souls would have been saved. The impracticability of approaching the engine-rooms and machinery precluded the possibility of stopping the engines. The way on the vessel being eight miles an hour, rendered the rescue by the boats next to impossible; first, by the boats themselves being dragged under, and next the difficulty of getting a footing in those boats, which were successfully launched into the turbulent ocean, rendered more so by the broken water from the paddles. How different would have been the position of the people, had the vessel been stopped, and subjected only to the undulations of the sea! The proposition is, the adoption of an arrangement to intercept the passage of steam from the steam-chest to the cylinder (or to each of two or more) by means of a two-way cock in the steam-pipe, the handle of which is to be carried up above the deck, to enable the captain or officer in charge on deck to shut off the steam under such cases of emergency, which of course implies the stoppage of the engines. The existence of such an arrangement in the instance of the *Amazon* would have made all the difference towards the launching of the boats and the salvation of the people, and probably every soul would have been rescued.

It is not alone in *similar* disasters that such an application would be useful and effective. There are occasions when the time consumed in communicating with the engineer would not allow the avoidance of a collision with a craft or boat suddenly running athwart the bows of a steam-ship, and noticed too late—especially in fogs. By such an instantaneous power of cutting off the steam, the vessel's speed would be retarded, and give time for reversing the action, and then turning the steam on again; and under any circumstance, the collision, if it should occur, would be somewhat diminished if not avoided altogether, with the simultaneous assistance of the helm.

C. B. C.

INSURANCE OF WORKMEN'S TOOLS.

The value of the workmen's tools destroyed by fire at the Messrs. Collard's manufactory is said to have exceeded on an average 25*l.* per man; and very few of them were insured.

The humbler classes of society are frequently blamed for not insuring their little property against fire, seeing that to them the loss of tools or furniture, too often brings ruin to the unfortunates, for a single conflagration may deprive them of the hardly earned savings of many years; but, in excuse for such improvidence, it must be called to mind that various obstacles stand in the way of insurance of small and fluctuating property like that in question.

In the first place, insurance companies require for their security against fraud, a certitude that the property insured really does exist; this is easily enough effected by means of their surveyor in the case of persons having fixed residences, and is not too costly where the property insured is considerable; but operatives of many descriptions have frequently to change their abodes; indeed, so have often the labouring classes to do so, according as work is more certainly, or more advantageously to be obtained in one quarter than another. True it is, that on such classes the insurance companies require nothing more than that notice should be given, so that their surveyor may inspect the

premises. The trouble, however, such notices occasion is too onerous both to the insured and the insurer where properties are small, and far too costly to a company by the absorption of so much of a surveyor's time.

Another obstacle to small insurances is the uncertainty that articles insured continue, as well as that they once were, in the possession of the insured. This operates on the insurer's readiness to grant a policy, but still more powerfully on the working man, for he feels it a check upon his disposal of any part of his tools or goods, although they might cease to be useful to him, or that in case of illness, or want of work, it might be desirable to part with some portion of such possessions. However improvident it may be to have recourse to this expedient, still it must be called to mind how very frequently the practice is resorted to.

A farther cause of disinclination to insure against fire, is the *tax* upon it. That tax much exceeds the premium for which insurance companies will insure against ordinary loss by fire, including profit, and all expenses of management as well as risk. To copy from a receipt from the Sun Fire-office for an insurance on 600*l*., the premium is but 10s. 6d., whilst the duty amounts to no less than 18s. If it be good policy in Government to foster prudential habits in a people, repeal of the tax on insurance would be a wise measure.

Difficult as it is to convince the humbler classes of the advantages afforded by insurances of every description, it seems particularly desirable to do away with all real obstacles to it; in this view the following scheme is suggested as appearing to be practicable, or, at least, in the hope of drawing attention to the subject.

In the first place, as to workmen, where a considerable number are employed in the same manufactory, at at the Messrs. Collards, might not the *proprietors* insure the tools of their operatives in one and the same policy? *Gratuitously* is *not* proposed; gratuitous advantages being rarely valued at their real amount, besides that they are apt, if considered as a bounty, to diminish the self-respect of the recipient; and although the rate of wage might be made to correspond with the amount of indirect advantage afforded, still it would diminish that simplicity so desirable in all transactions between employers and the employed. It is as reasonable on the master's side that what he pays his men for should fully appear, as that on their part no deductions should be made from the stipulated amount of wages. So also, the operative should be free either to risk at his pleasure the loss of tools, or to insure them against destruction by fire—whether it were the penny or the pence required to be monthly deposited with the master on this account, according to the value of the tools, and whether the risk were simple or hazardous. At simple insurance, a penny a month would more than have insured the whole stock of tools of that man at the Messrs. Collards who is said to have lost 50*l*. worth. By some such arrangement the petty trouble and annoyance to the insured would be avoided. An insurance company would thus have far greater security than when dealing with individual workmen; for the foreman in a great establishment would well know the value of tools belonging to the employed under his supervision, and would daily be aware should any of the articles insured be taken from the manufactory.

This mode of insurance is, of course, applicable only to establishments where many hands are employed; but a somewhat analogous one might suit for the members of benefit clubs and societies, the manager and accountant in this instance taking the place of the proprietor of a manufactory. Additional trouble would necessarily attend due ascertainment of the existence and the value of tools and goods insured, so that it would be but reasonable that some small compensation to the manager for this trouble should be added to the premium for insurance.

So there might be separate societies for the sole purpose of effecting the insurance of small properties against fire, the manager in this case being responsible to an insurance company that tools or goods to the value insured really did exist upon premises consumed by fire.

This project is broached only as a first step towards the attainment of a desirable measure, that of enabling operatives and the humbler classes to protect themselves with little trouble or expense from loss by conflagration. A mere hint will sometimes suffice for the maturing of a desirable measure, and, in good hands,

bringing it practically to bear, though it may be long afterwards. It was not till many years after Jeremy Bentham published his conception of the advantages savings banks would afford, that other persons realized his project; not that this example is quoted as indicating that insurance against fire is of equal importance with savings banks—far from it; although, were insurances of every kind very generally resorted to, the effect would be a diminution of human suffering to an incalculable amount.

M. S. B.

MR. BABBAGE AND THE GREAT EXHIBITION.—(CONCLUDED FROM P. 51.)

We have wandered in our preceding remarks a great way from the professed subject of Mr. Babbage's book, which is "The Exposition of 1851;" but this has arisen naturally enough from the scheme of the work itself, in which the Exposition holds but a very secondary place. Full one half of the book has nothing to do with the Exhibition at all, and is admitted, indeed, to have been in type some time previous to its opening. Avowedly, the author's object was less to show what was to be learnt from the Exposition, than to show certain things which could *not* be learnt from it. "To suggest to inquirers the agency of those deeper seated and less obvious causes which can be detected only by lengthened observation, and to supply them with a key to explain many of the otherwise incomprehensible characteristics of England" (Pref.) The word "Exposition," in fact, has been put at the head of the work merely to help it into circulation, because it is a word which happens for the time to be uppermost in the public mind; or to speak more correctly, perhaps, it has been made a peg of (for its tallness' sake), on which Mr. Babbage might hang his mantle, while pointing out to public indignation where this and the other "envious Casca" drove his dagger through. We think Mr. Babbage would have better consulted his reputation had he chosen a truer title. A writer of his high standing and wide popularity can stand in no need of any such petty adventitious aids, and he does himself as well as the public great injustice in having recourse to them. He has never hitherto missed a favourable hearing from the public, and would not now had he stood on his own claims to notice, instead of doing battle under a sham flag. He should have called the work what it really is, a "Sequel" or "Supplement" to his old and well-known work on "The Decline of Science in England," and its "Causes." Nor would he have been blamed for undue egotism had he added, "Including a True and Faithful History of the Calculating Engines, and Authentic Exposure of the Persecution of their Author." For as he himself truly observes (in substance), there could be no better illustration of the position of science in this country than the treatment which these engines and their author have experienced. (Pref. viii.) It furnishes the very "Key" he talks of—the key to the "many otherwise incomprehensible characteristics of England."

The pedlar sort of use which Mr. Babbage has made of the "Exhibition" (or "Exposition" as with idle singularity he persists in calling it) is the more to be regretted, since there is nothing in all that part of the book which relates to the Exhibition, which is at all calculated to raise his reputation; or rather, let us say, since to *raise* it is impossible, which is worthy of it.

Chapter I. consists of an "Introduction" on the difference between universal and general principles which, has no particular bearing on the Exhibition, and would serve to introduce any other subject whatever quite as well.

Chapter II. is devoted to showing that "a free and unlimited exchange of commodities between nations contributes to the advantage and the wealth of all;" a truth which is now so much of a truism in general acceptation, as to require no demonstration.

Chapter III. treats of "Societies," and is chiefly remarkable for a weak endeavour to trace back the origin of the Exhibition to the operations of the British Association, in which Mr. Babbage has, from the first, taken a leading part.

Chap. IV. Headed "Origin of the Exposition of 1851," is a whole chapter of errors in point of fact; disclosing but little of the real history of the affair, and displaying a disregard to the claims of its actual originators which in a person so sensitively alive as Mr. Babbage to neglected merit (where he is himself the victim), is particularly ungracious. In the course of this chapter, the disgraceful fact is made known, that of the liberal amount subscribed "nearly 90,000*l.*" "only 60,000*l.* have been paid," and the author interposes this judicious advice:

"No subscription ought ever to be advertised until it has been actually paid. It is quite unjustifiable to employ the money of *bonâ fide* subscribers in paying for advertisements to gratify the vanity of those who are ambitious of appearing as large donors, and who are yet so mean as to decline fulfiling their pledges," p. 33.

Chapter V. treats of "the object and use of the Exposition;" and is to be commended for this, that while repeating all that has been said over and over again, *usque ad nauseam*, about its certain tendency to make the nations better acquainted with their respective productions and capabilities, it is discreetly silent on its alleged "universal fraternity" and Peace-at-any-price-arian influences.

Chap. VI. discusses "the limits" which should be necessarily assigned to such an exhibition; approves of the partial mixture of the fine and useful arts which the Crystal Palace exhibited; but, rather strangely, passes over untouched the cognate inquiry —How it happens that a world's exhibition should be so necessary to the development of the useful arts, and how the fine arts should thrive so vigorously without anything of the sort?

Chap. VII. inquires into "the site and construction of the building;" which now that the Exhibition is a thing of the past, are matters of no moment whatever.

Chap. VIII. is occupied with the propriety of affixing "prices" to the articles exhibited; all very well, as respects the Exhibition, but surprisingly wrong as respects the prevailing practice among shopkeepers—inasmuch as the Author ascribes the omission of price-marks to a desire of imposition, when the truth is, that it has its source in notions of respectability of the highest traditional authority, and deserving of all respect.

Chap. IX. treats of the "prizes" offered, but with undeserved lenity, of the promises of large prizes made, in the first instance, in order to gain popularity for the scheme; the subsequent abandonment of these prizes, on the pretext that there were no funds out of which to defray the expense; and the ultimate forgetfulness of all these promises when funds in abundance were forthcoming:

"The great feature of the original plan of the Exposition was to give large prizes. One, at least, was to have been 5,000*l.*, and the whole amount of them 20,000*l.*

The anticipation of these prizes gave hope and industry to thousands: means were examined and measures taken by many a workman, at the expense of great personal sacrifices, to enable him to complete a model of some favourite scheme, by which he might hope to win one amongst the many pecuniary prizes, and thus be repaid at least for a portion of his efforts.

The announcement on the continent of these liberal arrangements was received with unbounded astonishment and admiration. The magnitude of the great prize seemed to foreigners incredible, and the liberality of offering it to the competing world, was altogether beyond their conception of the character assigned to us as a nation.

It was certainly very unfortunate that such an announcement should have been made and then withdrawn."

A blot, this, which no degree of success will ever wash out.

"Juries, &c.," furnish the subject of Chap. X. The author throws out some good hints as to "the principles" on which juries should act in awarding prizes, but forgets to show, as he ought to have done, first of all, the possibility of forming, in such cases as those presented by the Exhibition, an honest and impartial jury. All the world knows now, that there never was greater injustice perpetrated than under the sort of jury-system adopted at the late Exhibition, and Mr. Babbage does not show how it could have been otherwise.

"Ulterior objects" engross the last chapter (XII.) devoted to the Exhibition. It

shows many valuable uses to which it may be turned, but encumbered with a condition (a hobby of Mr. Babbage's), which may be safely pronounced as out of the pale of possibilities, namely, that it shall be removed to the vacant space on the western side of Park-lane, between Hyde-park Gate and the Marble Arch, "though at an expenditure of forty, or even fifty thousand pounds!" Mr. Babbage is an advocate for preserving the building, but would rather see it put fire to, than be a party to the breach of public faith which the preservation of it in its present locality would involve.

Then follow a series of chapters which form the marrow of the book, and but for which the book would, in all probability, never have made its appearance. They are headed "Intrigues of Science," "Position of Science" (in both of which chapters science and men of science are manifestly and improperly confounded), "The Press," "Party," and "Rewards of Merit."

The more one reflects on the facts disclosed or expatiated upon in these latter Chapters, the more one feels convinced that Mr. Babbage is, indeed, one of the worst used men in all England. Deserving of the highest honours, he has received none. Entitled by his merits to be presented to the assembled representatives of the nations, as one of England's most illustrious sons, he has been shamefully slighted and put aside. Admired and esteemed by the great body of his countrymen, he has been made the victim of a base and unprincipled clique. If such things are to be longer tolerated amongst us, England should efface the noble-hearted lion from her banners, and substitute some of the inferior order of animals in its place—a viper *couchant*, for example, or a sheep *rampant*, of the black-faced sort, with the *shanks* well displayed.

On a former occasion we animadverted—with some harshness, we fear—on the excessive hankering after worldly honours and distinctions displayed by Mr. Babbage, as being alike unphilosophical and unwise; but for this failing—if failing it be—he apologizes, in the present volume, in a passage of great beauty and pathos, which will not fail to commend itself to the sympathy of every true-hearted and generous reader:

"The consciousness of power, and the conviction of its successful exertion, exist undiminished by the neglect or the ingratitude of the country he inhabits. The certainty that a future age will repair the injustice of the present, and the knowledge that the more distant the day of reparation, the more he has outstripped the efforts of his cotemporaries, may well sustain him against the sneers of the ignorant or the jealousy of rivals.

It is possible that in some rare instance such a man may feel personally little ambition to attain what all others covet; still, however, he may be bound by other ties which link him inseparably to the present.

He may look with fond and affectionate gratitude on her whose maternal care watched over the dangers of his childhood; who trained his infant mind, and with her own mild power, checking the rash vigour of his youthful days, remained ever the faithful and respected counsellor of his riper age. To gladden the declining years of her who with more than prophetic inspiration, foresaw as woman only can, the distant fame of her beloved offspring, he may well be forgiven the desire for some outward mark of his country's approbation.

If such a relative were wanting, there might yet survive another parent whose less enthusiastic temperament had ever repressed those fond anticipations of maternal affection, but who now in the ripeness of his honoured age, might be compelled, with faltering accents, to admit that the voice of the country confirmed the predictions of the mother.

Perhaps another and yet dearer friend might exist, the partner of his daily cares, the witness of his unceasing toil; whose youthful mind, cultivated by his skill, rewards with enduring affection those efforts which called into existence her own latent and unsuspected powers. When driven by exhausted means and injured health almost to despair of the achievement of his life's great object—when the brain itself reels beneath the weight its own ambition has imposed, and the world's neglect aggravates the throbbings of an overtasked frame, an angel spirit sits beside his couch ministering with gentlest skill to every wish, watching with anxious thought till renovated nature shall admit of bolder counsels, then points the way to hope, herself the guardian of his deathless fame.

The fool may sneer, the worldly-wise may smile, the heartless laugh—the saint may moralise, the bigot preach: there dwells not within the deep recesses of the human heart one sentiment more powerful, more exalted, or more pure than th-.e.

That man is not a statesman, who is unaware of the strength of these powerful excitements to human action. Cold and incapable of such sentiments himself—no grasp of intellect enables him to infer their existence, and to supply the deficiencies of his own, by an insight into the hearts of others.

That man is a *fool*, not a statesman, who knowing their strength, hesitates to avail himself of it for the benefit of his country and of mankind."—P. 227.

IN RE BABBAGE V. SHEEPSHANKS.

"If this be not subornation of perjury, it is very like it."—*Mech. Mag.*, Jan. 17, 1852.

Sir,—The perusal of the able article in your Journal, from which the above extract is taken, has called to my mind a parallel instance of quasi-subornation of perjury, which you may perhaps deem not unworthy a corner in your pages, illustrating as it does very strongly how British workmen are but too often injured in their reputation by foreign counterfeits, and how the practice derives encouragement from the low state of moral feeling prevailing as well among scientific (or rather pseudo-scientific) as among fashionable circles.

For very many years, I was on terms of the closest intimacy with the late Mr. Troughton. Calling, as was my habit, almost every day, I found him on one occasion in a state of great agitation; I asked him "What was the matter?" he said, "*That* fellow, Dick ————, has just left—he has been abroad, and has brought from Paris, one of Jecker's circles—he tells me 'that to avoid payment of duty for it, he has had the name of "*Troughton*" engraved on it'—and he has asked me 'to let one of my workmen go down to the Custom-house, and clear it for him as an *English* instrument.'—I told him I would rather cut off my right hand, than be concerned in such a rascally transaction; and from what he said, I am not sure if W. . . . . . is not as deep in the mud as Dick is in the mire." I replied, "I hope not." Mr. Troughton then said, "I told the fellow, if he wanted to rob the Revenue by perjury, he must get some other person to help him; and he went away in great dudgeon."

Some few days afterwards, calling on my old friend Troughton, I crossed him in the passage, between his shop and his parlour, as he was coming down stairs; taking me by the hand, he led me to the window at the further part of the room, and bowing to the window sill, he introduced me, with a look of contempt, which I shall never forget, to a *circle*, which was lying there; he put it into my hands, saying, "It was the Jecker's Circle, which S . . . . had got from the Custom-house, but whether by swearing to a lie himself, or by having gotten some one to swear to a lie for him, he did not know." He pointed to the name of "Troughton" engraved on it, said, "The imitation was a very good one, and the fellow was an expert forger." I am, Sir, yours, &c.,

JAMES SOUTH.

Observatory, Kensington, July 19, 1852.

AMERICAN BACK-STITCH SEWING MACHINE.

Mr. Walcott, of Boston, exhibited Robinson's back-stitch sewing machine, in operation before the meeting, which excited much admiration from the members present, and made the following remarks:

This useful machine was patented in December, 1850. The object of the invention is to produce either what is generally termed stitch and back-stitch sewing or ordinary sewing; but this machine not only sews the regular back stitch, but, with slight mechanical adjustment, the basting, whipping, quilting, and cordwainers. There is a combination of two needles, two thread guides, and a cloth-holder, made to operate together, each needle having a spring to which pressure is applied in passing through, which spring retains the thread. The whole is worked by a wheel which governs and regulates the motion, with a handle on the wheel, which could be turned by a child; the whole apparatus showing great mechanical skill and ingenuity.

The advantages claimed for this machine over all others, are the durability and the fastness of the stitch, the perfect simplicity and compactness of machinery, and the many purposes to which it can be applied. The stitch taken by this machine is a *fac-simile* of hand-sewing, consequently it can be successfully applied to the same purposes. It also possesses many advantages even over hand sewing, which the practical tailor admits. The sewing produced is more accurate, makes a firmer seam, and is more durable than that done by hand. In hand sewing, at intervals of stitches, the thread remains loose, and therefore allows the stitch taken to slack, which we overcome by keeping the thread continually tight by means of thread-holders, which act in the capacity of fingers.

In seaming clothing with silk, it is very necessary that the silk should be waxed to give a firm seam. It is well known that all kinds of silk will stretch about one inch in ten. This machine will work the silk waxed as well as without.—*Proceedings of Franklin Institute.*

METROPOLITAN WATER-WORKS.—FORMULÆ FOR ASCERTAINING DIAMETERS OF PIPES.

Sir,—The engineers to the companies for supplying water to the metropolis have an impression that the diameter of their main pipes should be 30 inches, without much regard to the areas of the pumps of their engines, or of the orifices of the sources of the water; and whatever may be the length, though extending to many miles, that this pipe should be a cylindrical pipe, or pipe of an uniform diameter, without any regard to the increasing retardation by air, friction, pression, bends, slips, and other obstructions in the course of the water to its outlet. Perhaps the circulation of the accompanying paper may be the means of effecting a great saving of money to the members of these companies.

AQUARIUS.

Jan. 17, 1852.

To find the curved surface of a cylindrical pipe, or pipe having the same diameter or bore throughout, and the solidity or the quantity of water or other matter enclosed by that surface,

Let p = the perimeter or circumference of the base.
d = the diameter.
a = the area of the base $= ,07958 \times p^2 = ,78539 \times d^2$.
h = the height or length.
c = the curved surface $= ph$.
s = the solidity $= ah$.

The diameter of a pump or other orifice of a source of water running with a certain velocity being given, to find a system of cylindrical pipes, the smallest being the same diameter as the given orifice, the others increasing in diameter in a given ratio of increase to the outlet. Let the system of pipes contain a quantity of water equal to a cylinder of the diameter of the orifice of the source, and one-third more, or other allowance to compensate the retardation of the current of the water proceeding from friction, pression, bends, dips, and other obstructions in the aqueduct; and let the ratio of increase be in that of a frustrum of a cone.

To find the diameter of the great end of the frustrum, the small end being given, and of the small end, the great end being given; also the solidity and the curved surface of the frustrum.

Let A = the area of the great end
a = the area of the small end

$$\sqrt{A} = \sqrt{\frac{35}{h} - \frac{3a}{4}} - \sqrt{\frac{a}{2}}$$
$$\sqrt{a} = \sqrt{\frac{35}{h} - \frac{3A}{4}} - \sqrt{\frac{A}{2}}$$

h = the altitude or length.
s = the solidity $= \frac{1}{3} h (A + a) + \frac{1}{3} h \sqrt{Aa}$.

Let P = the perimeter of the great end $= \frac{2c}{H} - p$.
p = the perimeter of the small end $= \frac{2c}{H} - P$.

H = the slant, height, or length.
C = the curved surfaces $= \frac{1}{2} H (P + p)$.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JANUARY 22, 1852.

THOMAS SANDERS BALE, of Cauldon-place, Stafford, manufacturer. *For certain improvements in the method of treating, ornamenting and preserving buildings and edifices, which said improvements are also applicable to other similar purposes.* Patent dated July 17, 1851.

Claims.—1. The facing of buildings and edifices externally with plain hollow, corrugated or indented casings, tiles or slabs, termed by the patentee, "weatherproof ceramic casings," such casings being either self-vitrifying bodies, or veneered, coloured, ornamented, vitrified and glazed as described.

2. The ornamenting and preserving the interior of buildings and edifices by means of such casings adapted and applied thereto.

3. The casing of the exterior and interior of buildings and edifices with various kinds of bricks, blocks, &c., termed by the patentee "glazed veneered bricks," such bricks being either self-vitrifying bodies or ve-

neered, coloured, ornamented and glazed, as described.

4. The manufacture of blocks, cornices and other architectural subjects, either in self-vitrifying bodies or veneered with coloured surfaces burnt in, or on the body, and vitrified, ornamented and glazed, in order to be made weather proof; and the application of the same to form chromo-encaustic architectural works, in contradistinction to the ordinary porous terra-cotta, paint, &c.

5. The coating of bricks, tiles, blocks, slabs or casings for buildings, either before or after firing, with a superior surface applied thereto as "slip," "dust," or "layer," termed in every variety, "veneer," and coloured, vitrified and glazed; and also the veneering with other substances, as stone, glass, and vitrified surfaces, such articles in a fired state, and the application thereof to the ornamenting and preserving of buildings.

6. The manufacturing of tiles, quarries, slabs or blocks, hollow, for floors or pavements, and the ornamenting of floors and pavements thereby.

7. Certain methods of treating and ornamenting solid tiles, quarries, slabs, bricks or blocks for floors or pavements, tesseræ, &c., and of imitating tesselated or mosaic work.

8. The manufacturing and veneering simultaneously bricks, tiles and all such articles formed of plastic materials, as are, or may be employed for building purposes by means of suitable apparatus.

9. A method of perfecting or finishing hollow bricks, tiles, or blocks.

10. The application of glass and other diaphonous tiles, or slabs treated and ornamented in manner described for the construction of flooring or pavements.

11. Certain modes of treating building stones or blocks, by vitrifying or veneering and vitrifying the surfaces thereof, or by chipping out portions of the surface of the stone, and filling in the chipped out portions with slip, and then glazing and vitrifying the same.

Thomas Wilks Lord, of Leeds, flax and tow machine-maker, and George Wilson, director of the Flax Works of John Fergus, Esq., M.P., of Prinlaws, Fife. *For a machine to open and clean tow and tow-waste from flax and hemp and other similar fibrous substances, and an improved mode of piecing straps and belts for driving machinery, and a machine for effecting the same.* Patent dated July 17, 1851.

The machine for opening and cleaning tow is composed of a cylindrical cage of iron rods laid in a horizontal position, and having a shaft with projecting beaters or pins, disposed in helical lines, revolving within it. At each end of a casing which encloses the cage are trunks in communication with a fan or other exhausting apparatus, and at the discharge end of the apparatus is placed transversally a wire cylinder, which revolves almost in contact with a belt or apron, by which the cleaned material is discharged. The flax or hemp, on being fed into the machine, is subjected to the action of the beaters, by which, in combination with the exhaustion of air produced by the fan, the dust and shive are separated, and fall through the bars of the cage on to a table beneath. The beaters pass the material gradually through the machine, and the cleaning operation is concluded by the remaining portion of dirt falling through the wire cylinder, by which the material is then delivered from the machine in the form of a lap.

The claims under this branch of the invention are—

1. The general construction and arrangement of the machine.

2. The employment, for the purpose of cleaning tow and tow-waste, of a series of arms or pins, ranged in a spiral line around a shaft revolving within a cage or grated receptacle.

3. The employment of a wire cylinder, fan, and delivery table, for the purpose of forming the tow into a lap as it leaves the machine.

4. The employment of a feed-table to supply tow to the machine.

The "improved method of piecing straps or belts" consists in employing for that purpose short tubes of metal, which are inserted in holes punched in the meeting parts of the strap to be joined together, and have their ends bent down, or turned over, so as to hold the parts securely. The patentees here describe a machine for effecting this, which acts on the principle of a screw press —the ends of the tubes being bent down by compression between two cupped dies, having points in the centre of the cups to prevent the tubes from slipping, and at the same time to facilitate the operation.

The claims under this branch of the invention are—

1. The connecting of the ends or piecings of driving straps by means of tubes or ferules.

2. The general construction and arrangement of the machine for effecting the same.

William Dickinson, of Blackburn, machine-maker, and Robert Willan, of the same place, mechanic. *For certain improvements in machinery or apparatus for manufacturing textile fabrics.* Patent dated July 17, 1851.

The present improvements consist in a peculiar arrangement of fast and loose reed for the purpose of preventing injury to the warp threads by the beating up of the reed when the shuttle stops in the shed, in conjunction with a method of stopping the motion of the loom when this casualty occurs, and a method of relieving the pressure of the swell in the shuttle-boxes.

The reed, instead of being firmly attached to the slay cap, is supported at its lower edge, and held fast by taking into a groove in the slay cap so long as the shuttle passes freely across the loom, but when the shuttle misses boxing, the reed is released from the slay cap, which is raised by a lever acted on by an arm in connection with a spring, one end of which bears against the back of the swell in the shuttle box, and which spring, in the absence of the shuttle, is allowed to press the swell forward, and thus actuate the parts by which the release of the reed is effected. The slay continues, however, to beat up after the reed has quitted the slay cap; and this further forward motion is caused to take effect on a handle by which the driving shaft is shifted from the fast to the loose pulley, and the motion of the loom is thus stopped.

Another arrangement of loose reed is also described, in which the slay cap is stationary, and the reed is released by the lowering of the support on which it rests, which movement is produced, as before, by the reaction of a spring against the back of the swell in the shuttle box, when released from pressure by the shuttle missing boxing.

Claims.—1. The new arrangement of the stop motion.

2. The fast and loose reed, as described.

3. The method of relieving the pressure of the swell in the shuttle box.

Arthur Albright, of Birmingham, manufacturing chemist. *For improvements in the manufacture of phosphorus, and in the apparatus to be used therein.* (A communication.) Patent dated July 17, 1851.

This invention consists of an improved method of treating phosphorus, whereby it is rendered amorphous and non-crystalline, and so far modified in its general character as to be capable of being readily removed from place to place without danger. It is also changed in colour, and deprived of much of its poisonous nature and offensive smell, and does not ignite under friction or percussion, unless the heat generated thereby exceeds 464° Fahr., the point at which the amorphous phosphorus is inflammable being 482° Fahr.; neither is it so liable as ordinary phosphorus to become converted to phosphoric acid when exposed to the influence of a warm temperature; but when mixed with chlorate of potash, it becomes highly inflammable, and may then be used for the manufacture of lucifers and other similar articles.

These results are produced by the application of heat to ordinary-manufactured phosphorus while access of air is prevented.

The phosphorus to be operated on is placed in a glass or porcelain vessel, inside a closed cast iron pot, which has a pipe communicating with a vessel containing quicksilver and water, or water only. The cast iron pot is placed in a sand bath, which again is placed in a metallic bath, to which is applied the heat necessary for conducting the operation. The application of moderate heat causes bubbles to escape from the pipe of the vessel containing the phosphorus, which ignite on coming in contact with the air; as soon as these bubbles have ceased to issue from the pipe, the temperature is raised to about 500° Fahr., and maintained at that point until the phosphorus is rendered amorphous. It is then lowered, and the phosphorus allowed to cool, when it is levigated under water, and strained or pressed in filter bags. When dry, it is purified by spreading it in thin layers on iron or lead plates, and applying heat, which may be that of steam. In order to remove any ordinary phosphorus which has not been converted to an amorphous condition, and which adheres to that which has been operated on, the phosphorus is washed in water, or its removal may be effected by the use of bisulphuret of carbon.

Claim.—The manufacture of an improved or amorphous phosphorous, and the apparatus employed in such manufacture.

John Hick, of Bolton-le-Moors, engineers. *For certain improvements in steam boilers or generators.* Patent dated July 17, 1851.

These improvements consist in the arrangement of two boilers, end to end, with an intermediate space or gas-chamber, two of the sides of which are formed by the ends of the two boilers, while the other sides are constructed or lined with brick or some other slow conductor of heat. The boiler, which contains the fire-place, is an ordinary Cornish boiler, that is, it has a central flue or two flues, side by side, in which is placed the furnace, while the second boiler is multitubular, and the effect of the intermediate chamber is to cause a more perfect combustion of the products of the furnace, and consequently to produce a better heating effect on the tubes of the multitubular boiler. The two boilers are each provided with safety-valves, and communicate by

branches with the same steam-pipe; they are also provided with a suitable feed-pipe for the introduction of water into each of the boilers simultaneously.

Claim.—The arrangement of two or more steam-boilers or generators with a gas-chamber formed or lined, and situated as described, for effecting a more perfect combustion of the products of the fuel.

JOHN MCNAB, of Midtownfield, Renfrew. *For certain improvements in stretching or drying textile fabrics or materials, and in the machinery or apparatus employed therein.* Patent dated July 17, 1851.

This invention has relation to the finishing of thread. The hanks, while in a wet state, are stretched at one end over an angular or wedge-shaped steam chest, and held distended at the other end by a swift or reel, which is capable of being adjusted to produce any required tension, and, when set in motion, causes the thread to be drawn over the steam chest, and thus exposes the whole of its surface to the drying action of the heated metallic chest. Blasts of hot air are also directed against the interior and exterior of the hank, so that the thread is thoroughly dried, at the same time that any snarl or twist which may exist in it is removed by its frictional contact with the steam chest. Instead of employing a fixed steam chest, and a revolving swift to draw the thread over it, a steam cylinder, rotating slowly, may be employed, in combination with a swift, or two cylinders revolving at different rates of speed, in order to produce on the thread the friction necessary to remove snarl or twist.

Claims.—1. The general arrangement of machinery, apparatus, or means for the treatment or finishing of thread and other textile materials.

2. The system or mode of treating thread or other textile materials by the combined action of frictional tension, or tension alone, heat, and air blasts.

3. The employment of wedge-shaped or angular steam-heated chambers for giving frictional tension to the treated materials.

4. The system or mode of finishing thread or other textile materials, by passing such materials over revolving steam-heated cylinders, either combined or not with swifts or carrying-barrels.

5. The system or mode of giving tension to textile materials during the finishing operation.

MOSES POOLE, of London, gentleman. *For improvements in axle-boxes for railway carriages.* (A communication.) Patent dated October 23, 1851.

Claims.—1. The construction of railway axle boxes with a moveable plate and aperture made through the front of the box, in combination with one another and the composition bearing and enclosing case, and made to operate as described. [The object of this arrangement is to admit of the composition bearing being readily removed and replaced by another when worn.]

2. A mode of applying and fastening the washer of axle boxes in place, the same consisting in making the recess which receives it in one piece with the axle box, in combination with contracting and springing the leather into the recess.

3. The supporting of the axle-box case on the composition bearing by projections or analogous contrivances applied to its sides, in combination with making the top plate of the case and the cap or side plate in one piece, separate from the rest of the case, and building them in place by recesses and projections, or analogous contrivances, the whole being intended to dispense with the use of screws or screws and nuts, in constructing railway carriage axle-boxes, and thereby to avoid not only the injury which frequently results from their becoming loose, but also the necessity of that care and attention on the part of the attendant which is requisite with axle boxes of the ordinary construction.

WEEKLY LIST OF NEW ENGLISH PATENTS

James Aikman, of Paisley, Renfrew, North Britain, calenderer, for improvements in the treatment or finishing of textile fabrics and materials. January 20; six months.

James Macnee, of Glasgow, North Britain, merchant, for improvements in the manufacture or production of ornamental fabrics. January 20; six months.

Thomas Kennedy, of Kilmarnock, North Britain, gun-manufacturer, for improvements in measuring and registering the flow of water and other fluids. January 20; six months.

Peter Armand Lecomte de Fontainemoreau, of South-street, Finsbury, for certain improvements in treating fibrous substances. (A communication.) January 20; six months.

Henry Graham William Wagstaff, of Bethnal-green, Middlesex, candle-maker, for improvements in the manufacture of candles. January 20; six months.

Peter Wright, of Dudley, Worcester, vice and anvil manufacturer, for improvements in the manufacture of anvils. January 20; six months.

John Whitehead the younger, of Elton, near Bury, Lancaster, dyer and finisher, and Robert Dingle, of the same place, foreman, for improvements in bleaching and dyeing, and in washing, scouring, and other processes connected therewith. January 20; six months.

George Lowe, of Finsbury Circus, London, civil engineer, and Frederick John Evans, of Horseferry-road, Westminster, civil engineer, for improvements in the manufacture of gas for the purposes of illumination, and of improvements in the purification of gas, and of improved modes of treating the products arising from the manufacture of gas. January 20; six months.

Frank Clarke Hills, of Deptford, Kent, manufacturing chemist, for improvements in manufacturing and purifying certain gases, and in preparing certain substances for purifying the same. January 22; six months.

Peter Armand Lecomte de Fontainemoreau, of South-street, Finsbury, London, for certain improvements in railways and locomotive engines, which said improvements are also applicable to every kind of transmission of motion. (A communication.) January 22; six months.

Edward Tyer, of Queen's-road, Dalston, gentleman, for certain improvements in the means of communication by electricity, and apparatus connected therewith. January 22; six months.

James Pillans Wilson and George Fergusson Wilson, of Wandsworth, gentleman, for improvements in the preparation of wool for the manufacture of woollen and other fabrics, and in the process of obtaining materials to be used for that purpose. January 22; six months.

Walter Marr Brydone, of Boston, for improvements in apparatus for signal and other lights for railways. January 22; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Jan. 16	3084	J. Humphreys	Lancaster	Presser-mould.
17	3085	T. G. Cressall	Finsbury	Steam-lock.
20	3086	S. Hood	Upper Thames-street	Stable fitting for loose-box.
,,	3087	W. Coulson	York	Morticing machine.
22	3088	H. Wilkinson	Pall-mall	Self-expanding solid rifle bullet.
,,	3089	Stephen Webb, of the firm of Walker and Webb	Oxford-street	Kuklosiphon, or fetlock boot.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

Jan. 16	348	W. D. Richmond	Birmingham	Wire, metal, &c., gauge.
,,	349	J. Worthington	South Shields	Parallel ruler.
17	350	J. Barker	Birmingham	Compensating cabriolet.
,,	351	Myers & Son	Birmingham	Universal India-rubber holder.
20	352	W. Cutlam	North Devon	Archimedian chimney-top.
,,	353	T. Blissett	Liverpool	Anti Garotte.

CONTENTS OF THIS NUMBER.

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MR. C. W. SIEMENS' REGENERATIVE CONDENSER FOR HIGH-PRESSURE AND LOW-PRESSURE STEAM ENGINES.

Fig. 2.

Fig. 1.

ON MR. C. W. SIEMENS' REGENERATIVE CONDENSER FOR HIGH-PRESSURE AND LOW-PRESSURE STEAM ENGINES.

(From "Transactions of Institute of Mechanical Engineers," July, 1851.)

The condenser of a steam engine has for its object the complete discharge of steam from within the working cylinder, after it has served to propel the piston. This is effected by conducting the expended steam into a closed chamber, containing an extended surface, of comparatively cool substance, which absorbs the latent heat of the steam, and thereby reduces it to its liquid state. Cold water is generally employed for this purpose, which is either brought into immediate contact with the steam, as is the case in Watt's Injection Condenser, or through the medium of metallic walls, as in the Surface Condenser by Hornblower, improved upon by Hall and others.

The more or less perfect condensation of the steam depends—

1st.—On the absence of air from the condenser.

2nd.—On the temperature at which condensation takes place.

The appended Table shows the elastic force of steam in vapour, at various temperatures. It will be observed that, in order to produce a perfect vacuum, the water should leave the condenser at about 32° Fahr., or be introduced in the form of ice. Condensing water, however, is generally obtained at the temperature of about 60° Fahr., and it leaves the condenser at about 110° Fahr., which latter temperature implies a remaining atmosphere of vapour equal to 2·5 inches of mercury, or in other words a vacuum of 27·5 inches below the atmospheric pressure at 30 inches. If a less quantity of condensing water be used, it will be raised to a proportionately higher temperature, and a less perfect condensation be effected. At 212° Fahr., the pressure of the uncondensed vapour would be equal to that of the atmosphere, and the object of the condenser would be entirely frustrated.

In all cases where an abundant supply of condensing water cannot be obtained, or where the heat of the steam employed by the engine is reclaimed for other purposes, steam engines are worked without a condensing apparatus (or at high pressure) at the sacrifice of an effective pressure nearly equal to that of the atmosphere upon the working piston. The *regenerative condenser* (the subject of the present paper) redeems the engine from this waste of heat in the one case, and loss of mechanical effect in the other case, being possessed of the peculiar property of returning the condensing and condensed water at the initial temperature of the steam previous to its discharge from the working cylinder (commonly speaking, at 212° Fahr.), effecting nevertheless an efficient vacuum.

Fig. 1 shows a sectional elevation of the regenerative condenser, as applied to a 10-horse power high-pressure engine. It consists of an upright rectangular trunk of cast iron A, the lower end of which, B, is cylindrical, and contains a working piston. The trunk is filled with metallic plates, which are placed upright, and parallel to each other, with intervening spaces of not less than one-sixteenth of an inch in breadth. The upper extremity of the condenser communicates on one side E to the exhaust port of the engine; and on the other to the hot well F, through a valve G. A stop H, prevents the opening of the valve beyond a certain distance, in order that it may re-shut more instantaneously. The metallic plates D are fastened together by five or more thin bolts, with small washers between the adjacent plates, which keep them the required distance apart. They can easily be removed from the condenser, for the purpose of cleaning, by taking off the cover I, and drawing out the whole of the plates.

An injection-pipe K enters the condenser immediately below the plates; it is provided with a small air-vessel L, and a regulating cock.

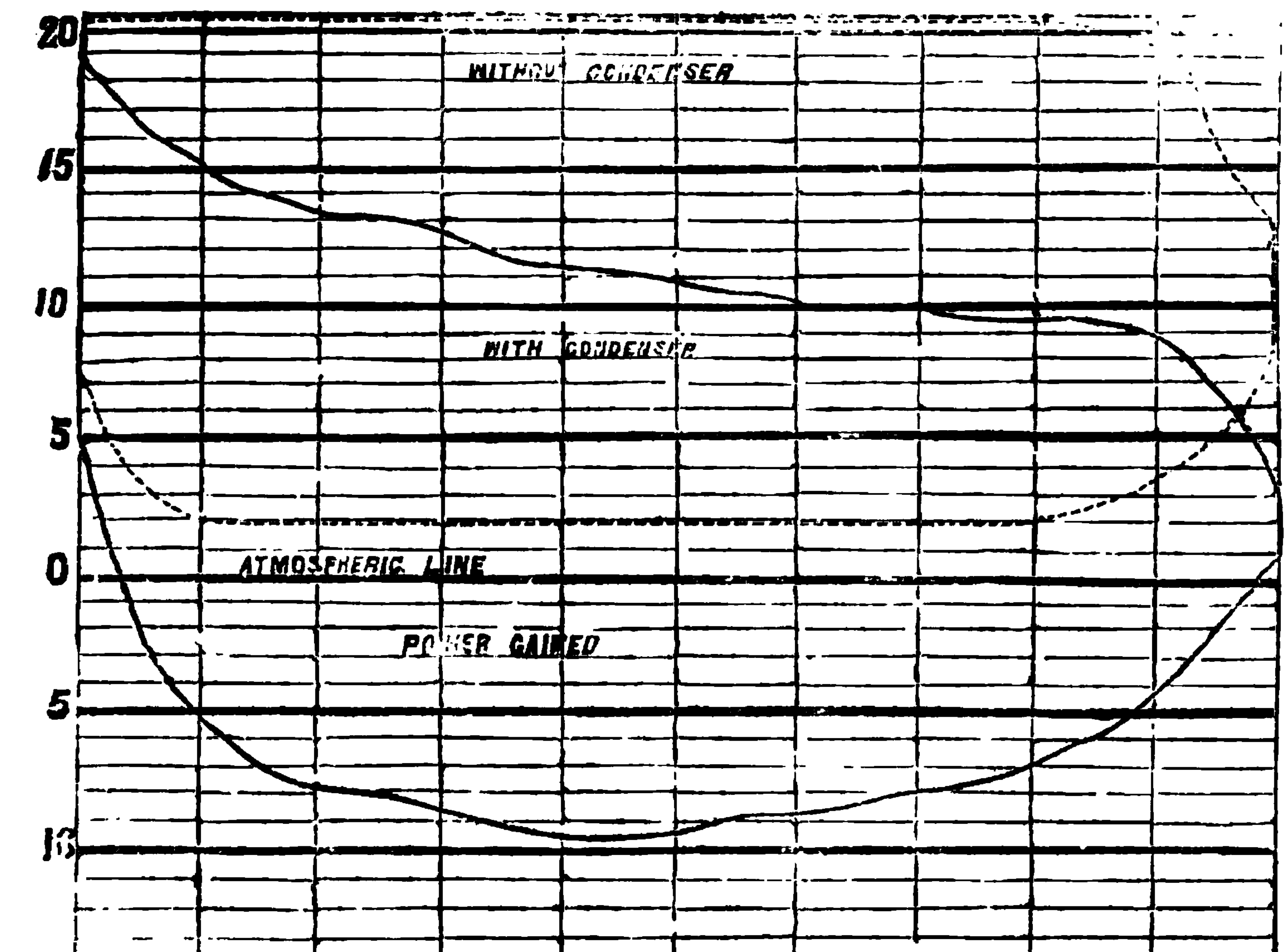
The action of the condenser is as follows:

Motion is given to its working piston by the engine, causing it to accomplish two strokes for every one of the engine.

At the moment when the exhaust pipe of the engine opens, the plates D are completely immersed in water, a small portion of which has entered the passage above the plates at A, and is, together with the air present, carried off by the rush of steam through the valve G into the hot well, where the water remains, while the

excess of steam proceeds into the atmosphere. An instant after the partial discharge of the steam cylinder has commenced, the water recedes between the plates D, and exposes them gradually to the steam, which condenses on them in the manner following:—The upper edges of the plates, emerging first from the receding water, are enveloped in steam of atmospheric pressure, and in condensing a portion thereof, they become rapidly heated to nearly the temperature of the steam, or about 210° Fahr. The partial condensation diminishes the density and temperature of the remaining steam, which requires additional and cooler surfaces for its further condensation. This is provided for by the continual emerging of additional portions of the metallic surfaces from the water. By the time the water-level leaves the plates, the far greater portion of the steam is condensed. The condensation of the remaining portion of steam could not so readily be accomplished by means of metallic surfaces, but the piston C continuing to descend, puts it into immediate contact with the jet of cold water from the pipe K, which completes the vacuum in the manner of a common injection condenser. The air-vessel L, connected with the injection pipe, has the effect of accumulating the injection water at the time when the water has ascended between the plates, and of forcing it into the condenser with increased intensity at the time when it is required to complete the vacuum.

Fig. 3.



Although the action of this condenser is strictly consecutive, yet it does not check the continuous flow of steam from the cylinder, and it completes the vacuum when the working piston of the engine has only accomplished one-tenth part of its stroke. Both the engine-crank and the crank driving the condenser are on the top centre at the same moment, but the latter completes its revolution in the time of half a revolution of the engine; consequently, when the engine piston has passed only one-tenth of the whole stroke, the condenser-crank will have travelled through nearly half its stroke, when the whole process of condensation will have been completed. The principal part of the latent heat of the steam is stored up in the plates, the upper extremities of which are heated to 210° Fahr., and the lower to about 150° Fahr.

The water, in re-ascending between the plates during the last tenth part of the stroke, absorbs heat therefrom in a similar successive manner, passing first the coolest, and by degrees the hottest portions of their surfaces, and issues finally into the upper steam passage, at a temperature approaching the boiling point, at which moment a fresh discharge of steam takes place, which carries it off into the hot well, as above described, and raises its temperature fully to the boiling point.

Fig. 3 represents an actual indicator diagram, showing the time occupied in completing the vacuum; but it will be observed, that the loss of time and power may be decreased by increasing the capacity of the displacing cylinder; but, as it is, this loss does not amount to one-seventh part of an uniform vacuum, an equivalent for which is obtained in the saving of the power hitherto absorbed by the air-pump; for it will be observed, that the displacing piston works between two vacuums, and therefore meets with no resisting load.

Various modes have been provided to give motion to the displacing cylinder, among which a knee motion, worked directly from the beam or cross-head of the engine, is generally found the most convenient, as shown at M M in fig. 1.

The quantity of condensing water required with this condenser to condense one pound of steam, of atmospheric pressure—taking the initial temperature of condensing water at 60° Fahr., the final temperature at 210° Fahr., the latent heat of steam of 212° Fahr. at 960 units—is

$$\frac{960}{210-60}=6\cdot6 \text{ lbs.}$$

of water to condense one pound of steam.

The common injection condenser (supposing the condensing and condensed water to issue at 100° Fahr.) requires

$$\frac{960+(212-110)}{110-60}=21\cdot2 \text{ lbs.}$$

in place of the 6·6 lbs. which the regenerative condenser requires. In the case of a locomotive, or other high-pressure engines, where the steam is released from the cylinder at a pressure of say 30 lbs. above the pressure of the atmosphere, two-thirds would be allowed to escape uncondensed, and a vacuum be obtained with only

$$\frac{66}{3}=2\cdot2 \text{ lbs.}$$

of condensing water for every pound of steam passed through the cylinder.

The small quantity of condensing water required, renders the proposed condenser applicable to engines in nearly every locality; and pains have been taken to render the apparatus itself equally light and compact. The advantages resulting from its application to high-pressure engines are as follows:

1. Additional effective power, gained on account of the vacuum.

Fig. 3 illustrates this gain, which (supposing the average steam pressure to be = 40 lbs. above the atmosphere, and vacuum within the cylinder = 10 lbs.) amounts to 20 per cent., irrespective of expansion. If both the steam pressure and the duty on the engine remain unchanged after the condenser is applied, it is evident that the steam may be worked expansively to a large extent, without diminishing the absolute driving power of the engine.

2. Heat saved in generating the steam, by the use of *boiling hot feed water;* and the remaining portion of hot water may be advantageously used for heating buildings, dyeing, &c.

High-pressure engines are frequently provided with heating apparatus for the feed water, which heats it on the average to about the temperature of the condensing water from low-pressure engines, or 110° Fahr. The proposed condenser heats it to 210° Fahr., which constitutes a saving of

$$\frac{210-110}{960}=\text{about 10 per cent.}$$

When such heating apparatus is not provided, the saving amounts to

$$\frac{210-60}{960}=\text{about 15 per cent.}$$

3. The steam which is not condensed may be used to cause a draught in the chimney, or for other purposes.

4. The displacing cylinder, unlike the pump of the injection condenser, abstracts no motive power from the engine.

5. The condenser may be started and stopped at any time, by turning the supply of injection water either on or off. If turned on, it at once forms the vacuum, without involving the necessity of blowing through; and if turned off, it allows the engine to proceed in the same manner as though no condenser had been applied.

Figs. 4. Fig. 6.

6. The air contained in the condenser is, at the commencement of each stroke, *bodily expelled*, which is of great advantage to the formation of a good vacuum, instead of the ordinary air-pump removing only a portion of the air at each stroke, and consequently leaving a portion always in the condenser.

7. The regenerative condenser is more compact, and even less expensive than the ordinary injection condenser, being less than one-quarter of the size, and having only one valve instead of three.

Its proportionate dimensions are as follows:—Area of plate-chamber, three times the area of exhaust pipe; length of plates, one-quarter to one-third part of length of stroke of engine; thickness of plates, $\frac{1}{32}$nd part of this length. Spaces between the plates, the same, but never less than $\frac{1}{20}$th of an inch, it having been found that the alternate rush of water and condensing steam prevents the settlement of grease and earthy matter between the plates, if they are not less than $\frac{1}{16}$th of an

inch apart. Capacity of displacing cylinder, equal to one-and-a-half times the capacity of the plate-chamber. The total capacity of the condenser is only equal to about the tenth part of the capacity of the working cylinder. In applying the regenerative condenser to existing high-pressure engines, a saving of fuel of from 30 to 35 per cent. has been effected, or an increase of power to that amount with the same expenditure of fuel as theretofore. This saving may, however, be still considerably augmented, if advantage be taken of the increased effective pressure to work the engine expansively. This may in most cases be easily effected, by merely adding to the lap of the slide valve, and increasing the lead of the eccentric proportionately, whereby the additional advantage of a more early discharge of the steam is obtained.

(*To be concluded in our next.*)

THE OPERATIVE ENGINEERS' STRIKE.—HOW SKILLED ARTIFICERS MAY BE DISPENSED WITH.

Experience has proved that the manufacture of engines and machinery can be carried on efficiently and profitably without the aid of a single operative who had served an apprenticeship, or who (in the general acceptation of the term) is denominated a *skilled* workman. This bold assertion is justified by what actually took place in carrying on manufacturing concerns on Government account, and that on an extensive scale in several very different branches of business; it may not, therefore, be without its use to string together quotations from a variety of official documents which prove the fact, and moreover that efficiency and skill are acquirable in a very short time by perfect novices in most of the manufacturing arts.

It is not usual to cite proceedings in Government service as exemplifying useful and economical practices, but on the present occasion it must be so. General Bentham, in the year 1795, was charged, on Government account, with the construction of sea experimental vessels of war, and on this occasion it was that he first began to break through the customs of trade. A few shipwrights from Royal Dockyards were lent to him, but to whom he was "obliged to promise *nine* shillings a day before they would consent to undertake the work" . . . "In my individual capacity," he says, "I could not induce any good workman from private yards to work for less. Six men of the river Thames who offered their services, although they were out of employment, refused to engage themselves for less than twelve shillings a day, besides travelling expenses and lodging." His extensive experience in a foreign country of the facility and expedition with which manufacturing skill is acquired, determined him to forego the services of men having such pretensions, and "induced me in the way of experiment," he said, "to engage a certain number of apprentices, most of whom were stout lads" . . . As to the quantity of work these lads soon were able to perform, in one instance in particular while they were employed in laying the decks of the *Dart* and *Arrow*, and when particular attention was paid to the separation of their work from the rest, it appeared that they did as much in the day, one with another, as would by measurement have amounted, according to the current price, to nine shillings, and even half-a-guinea each. He also engaged as apprentices "artificers practising analogous trades in which there is a superabundance of hands," such as house-carpenters and joiners.

These several apprentices could not "without infringing on what are considered as the privileges of journeymen shipwrights," have been allowed to work with the dockyard shipwrights otherwise than by binding them as apprentices to the General,—himself a shipwright, having been regularly bound to the master-shipwright of Woolwich Dockyard; and thus those privileges were, in fact, done away with, and the practicability of the measure fully exemplified, though but a half one, since so far deference was paid to the customs of the trade as to bind these persons by regular indentures.

Subsequently, however, Sir Samuel fully exemplified the practicability of carrying on great works without a single apprentice, and without a single so-called skilled artificer. It was first prac-

tised when his machinery for shaping and working wood was introduced at the end of the last century in Portsmouth Dockyard. Even in the making of those machines themselves on his brother's premises, though some journeymen millwrights had been employed, they had been trained to the work by himself; and one of his people, Burr, who had theretofore been a dockyard man, not a millwright, was selected for the introduction of his machines at Portsmouth and at Plymouth, "in the year 1802, when the quantity of machinery provided came to be considerable" . . . "Under his immediate directions some dockyard *labourers* were trained to the use of machines of this description" (those of Sir Samuel's invention) "and by means of some small extra allowances, they were encouraged to exert themselves in his employment."

In February 1805, Sir Samuel stated to the Admiralty that the working of that machinery was brought to a state in which it might be put into the hands of the Dockyard officer; and proposed an establishment for it. Some of the articles required in the dockyard were too few in number to justify the introduction of machinery for making them, and on this account a few experienced hands were engaged,—but otherwise the proposed establishment consisted solely of such persons as labourers and boys. "The doing away the need of *apprenticeships* was among the objects in view in giving at the outset the new name of the *wood-mills* to the establishment itself, and that of *wood-millers* to the workpeople employed in it." The Dockyard officers and the Navy Board having stated their incompetency to manage these mills, as likewise the metal-mills and the millwrights, the three establishments were put under Sir Samuel, and continued so till his office was abolished; on which occasion, in 1813, in giving officially an account of the manner in which he had executed the trust reposed in him, he said "Apprenticeships in this establishment have never been required, so that the competition for employment has been *open to all*" . . "All work *capable* of being paid by the piece is so paid for, and all possible care being taken that an individual shall have done a good day's work in order to make his pay by the piece amount to a fair day's pay,—whatever he earns more than that by *extraordinary* dexterity, or *extraordinary* exertion, however contrary to Dockyard usage, he is allowed to receive without limitation."

There were nine denominations of operatives in the wood-mills, and "these denominations were each of them again divided into two or three classes, at as many different rates of pay. The pay earned varied from ninepence to ten shillings a day—the *average* day pay, including the master, being two shillings and ten-pence; rates of pay which, considering that it was then the dearest time of war, will not be thought high"—considering too that the place was Portsmouth.

"As to the metal-mill, its management has been founded on principles the same as those I introduced in the other two establishments." No apprenticeships were required in it,—labourers and boys were employed wherever they were competent to perform any part of the works carried on in these mills.

The third of Sir Samuel's establishments was called the "Millwright's Shop," master machine-makers being at that time denominated millwrights, as well as the operatives in their employ. The privileges claimed by such men previously to the institution of the millwright's shop, their insubordination to the dockyard authorities, and the consequent needless extra cost of machinery, are in a slight degree exhibited in a letter to Sir Samuel, August 5, 1804, from the Master Shipwright of Portsmouth Dockyard; it ran as follows, "The house-carpenters were set to work on the frames for the circular saws, agreeable to your desire, on Monday last. The following day all Mr. Lloyd's men declined coming to work; after consulting Linaker, I found it prudent to take off the house-carpenters from that work to prevent delaying the various works the millwrights have in hand, and thus give way to a set of men combined together to do as they please, and who are certainly less worked than any set of men in this dockyard. It would be most desirable to get rid of them if possible, as their work must be very expensive beyond a doubt; and such insubordinate conduct is a very bad example to other people. "I am, Sir, yours, &c.,

"N. DIDDAMS."

Sir Samuel afterwards, in officially stating his motives for recommending the institution of the millwright's shop, specified the need there was of overcoming "the customs and privileges in use among millwrights; such as being paid double pay for night-work, by which, besides the great extra expense of double pay where work must necessarily be done at night, a strong inducement is afforded them to find causes for doing by night what might as well be done by day; and such is the pertinacity with which artificers of this description are known to resist all attempts at putting workmen of any other description to assist them, and which pertinacity they carry so far as not even to allow a labourer to turn a grindstone for them." . . "Although at the time of forming this establishment I had taken a comprehensive view of the beneficial effects that might ultimately be made to result from it, yet it was only by gradual steps and perseverance, and by a continued attention to all the particulars upon which the success of my plan depended, that I could have any hope of doing away the prejudicial customs of millwrights."

To show the nature of the difficulties he actually did encounter, and what is more to the purpose of the present struggle between the employers and the employed, to exhibit the good effect of perseverance in employers, the following letter to the Comptroller of the Navy is given at length. It was written from a sick bed, yet exhibits an energy which resembles that of the associated employers of machine-makers at the present day, and which in their case cannot fail to insure their ultimate success, though it may not be so immediate as it was t Portsmouth.

"*Portsmouth*,
"*4th Feb.*, 1812.

"Dear Sir,—When I wrote my letter to the Board of the 30th ult., not the least symptom of dissatisfaction had appeared among the millwrights, as I stated, in regard to my binding good workmen of other trades to their business, which I understood they were apprized of; but yesterday morning, it seems, most of the millwrights left their work, and complained to the master millwright that I was injuring them by taking adult apprentices, since those who had come to work might, in a month, be as good millwrights as themselves, and that I should then, they concluded, discharge them,—the present millwrights. The master shortly represented to them that I had no such intention; but twelve of them almost immediately came out to me, leaving time enough for their master to precede them and tell his story. I had been ill for some days,—confined to bed for the two last; however, I rose to see these men, and during the time they had to wait for my coming down, their behaviour was perfectly peaceable, as it continued afterwards so long as they were here, and subsequently, with the exception of one man. To me they repeated what they had said to Kingston, told me they had already been induced to give up the customs of their trade, but in general terms, said that the binding such apprentices was injuring them, as they would become no longer necessary. I represented to them that, on the contrary, it was far from my wish to do them any injury, that I had not the most distant intention of discharging any good and industrious millwright, though idle ones, or bad workmen, I certainly should continue to discharge, as they had seen I had done already; but that, as I could find employment for more hands, the apprentices in question should work in their shop; that if they, the millwrights, did not choose to work with them, I would carry on the work without millwrights altogether. They spoke of giving warning, and of quitting their work at the end of the week; but I told them their unwilling services would be of no use, and that those who objected to staying, should go immediately. There were only three or four of them who spoke. When I pressed them to tell me what the injury was they apprehended, the greater part of them confessed that, by taking any large number of younger apprentices, their fears of being thrown out of work might equally be realised, though at the later period of three or four years hence, instead of now; they still, however, represented that the taking apprentices who were already good workmen was injurious to them, that they could not work with those,—and left me.

"Shortly after they were gone, I sent money of my own to their master, sufficient to pay off the whole number if they should continue to resist, with strict injunctions to him not to yield to them

in any respect whatever. I was obliged to go to bed again myself; but Mr. Goodrich, who took my message to the Dockyard, continued there all the forenoon, as I had desired him to go to the Commissioner to tell him of what had happened, of my determination to get the better of the millwrights, and to request that he would not write anything whatever on the subject of these men until he should have heard what I have to say on this business.

"While Mr. Goodrich was in the yard, four or five of the men had been packing up their tool-chests, one or two had actually taken them away from the millwrights' shop; some of the men had never left their work, others were keeping out of the way until these refractory ones should be disposed of.

"This morning I understand that this striking is over. Amongst those who were the forwardest are one or two of the worst workmen, who, at all events, will be discharged, as will probably one of the good ones,—at most, three in the whole.

"What I conceive may have given rise to this apprehension of the millwrights that I was preparing to discharge them, is, that since I have been here, as I believe I told you was my intention, I have been breaking through one of the most mischievous customs of their trade, which had not before been ventured to be encroached upon; namely, that of double pay for working in the evening or the night. The consequence of this double pay had been found to be very prejudicial and costly; for as they well knew that, in regard to the mills and engines of the Wood and Metal-mills, as well as the Fire-extinguishing and Water-works, that if any part of them stood in need of repair, it must be done by night no less than by day, repairs of this kind were found to go on very leisurely by day, in order to leave a little work for the night; and the best endeavours of the master-millwright were not sufficient to prevent occasional concealment of the need for small repairs till towards the end of the working day. To put a stop to such malpractices, I had, therefore, the first week of this year, done away with the double rate of pay for night-work; since when, work done at whatever time of the four-and-twenty hours is always paid for at the same rate as that of the day's pay.

"I had also informed myself particularly of the qualifications and degree of industry of all the millwrights individually, and had discharged the worst of them. It is true, at the time of doing away with the emoluments they derived by night-work, I increased the pay of the four best hands sixpence per day, being less than what they are likely to lose by the above-mentioned regulation; but still I left a second and a third class at the same day-pay as theretofore, without any compensation for the loss of double pay at night in these inferior classes.

"Ever, dear Sir,

"Most sincerely yours,

"S. Bentham.

"The Comptroller of the
"Navy, &c., &c."

The amount of savings and of other benefits the public derived from this establishment, is not to the present purpose; but it is so that, when its management passed from Sir Samuel in December, 1812, "the millwrights retained are only those who are efficient workmen; they attend a regular muster; receive no greater rate of pay per hour for night-work than for work done by day; none but workmen particularly skillful are paid at so high a rate of pay as millwrights receive indiscriminately from private masters; the greater part of those employed at Portsmouth receive *inferior* rates of pay, according to their respective degrees of skill and dexterity; they not only allow *common labourers* to assist them whenever they are competent, but have admitted among them, under the sanction of indentures to the master-millwright for the time being, good artificers of other analogous trades, who are some of them able to do the best millwrights' work, and to keep pace with a good millwright, though they receive but the pay of house carpenters and joiners; indeed, the only prejudicial custom remaining to be broken through is, that the day's work is still limited by the daylight, even in a short winter day. This custom I deferred the attempt to abolish, until having an opportunity of being myself on the spot, I could cause the observance of the precautions which

seemed necessary to secure the success of such an alteration." He afterwards speaks of the establishment as being in a still "imperfect state."

The proportionate number of boys to be taken as apprentices was never limited in the millwrights' shop, but the entire doing away with millwright apprentices was not to be attempted in a Royal dockyard at a time of war, lest shipwrights should have made common cause with the millwrights in regard to this privilege, although it was not admitted in either the Wood or Metal-mills.

The Amalgamated Society complain that the prices allowed for task-work are, from time to time, lowered by master manufacturers; so they were in the Wood-mills. At the time of their institution, all of the machinery was then for the first time introduced as a manufacturing concern; the quantity of work which could be done in a given time by any one of the machines being unknown, they were therefore at first worked by day-pay men, and thus an approximation to a rate for task-work was obtained; afterwards, a variety of circumstances enabled a greater produce in the day to be obtained, and the rate of pay was lowered conformably; and so it must be in all private manufactories. A fair day's pay for a fair day's work is all that any operative is entitled to expect, —excepting only the few cases in which peculiar skill is requisite. Thus, the man John Newey, whose earnings have already been shown to have amounted on one occasion to two or three-and-twenty shillings a day, continued to excel. In the week ending 7th December, 1812, by six bare days' work at brass castings, he earned, and was paid, *4l. 4s. 6d.*, whilst the earnings of another operative, paid also by the piece, for brass castings, and working also six days, amounted to no more than ten shillings.

M. S. B.

THE KUKLOSIPHON, OR FETLOCK BOOT.

(Registered under the Act for the Protection of Articles of Utility. Stephen Webb, of the firm of Walker and Webb, 118, Oxford-street, Proprietor.)

Fig. 2. Fig. 1.

Fig. 1 is an external view, and fig. 2, a vertical section of this boot. It is composed of a conical-shaped sock or band A, to the lower end of which is attached a *hollow* ring, B; both band and ring are of vulcanized India rubber, to enable them to be easily drawn over the hoof of a horse and retain their position without exerting too great a degree of pressure on the leg.

The purpose of utility aimed at in the combination of this boot, and which it realizes very effectively, is to prevent a horse from "cutting" or hurting his legs by knocking his feet against them. It is at the same time easily retained in the desired position on the horse's leg.

THE CHATTERTON PADDLE-WHEEL.

In our last week's account of the trial of speed between the *Bridegroom* and the *Twilight* steam-boats, we reported that the latter had been previously increased in speed beyond the former to the extent of ten per cent. by the adoption of the zig-zag wheel of Mr. Lee Stevens, and that the *Bridegroom* was but brought to a par with the *Twilight* by being fitted with Mr. Chatterton's wheel. We have reason to believe that we have in this statement done, unintentionally, great injustice to the comparative merits of Mr. Chatterton's wheel, (misled by some expression in the information supplied to us), and take the earliest opportunity of correcting it. The following has been handed to us as the true version of the affair, and we have ascertained by personal inquiry of the engineers of the boats, that it is correct in every particular:

Corrected Statement.

Two boats belonging to the London and Westminster Iron Steam-boat Company were selected for the trial—the *Twilight* and the *Bridegroom*, because they are nearly the same size, and have each engines of the same power; but when working with the old or common paddle-wheels, the former was considered, and in fact proved, to be the faster boat by about 1¼ miles per hour; that is, she performed her usual trip from Nine-elms to London-bridge in 2½ minutes less time than the latter. The *Twilight* has been fitted with a wheel invented by Mr. Stevens, the peculiarity of which is, that the floats or boards are placed diagonally across the wheel, every alternate board slanting in an opposite direction; the effect of it is to obviate the shaking or tremulous motion usually imparted to vessels by the ordinary paddle-wheel, but without obtaining any increase in speed, and from the alternate lateral pressure upon the shaft, with some tendency to injure the bearings. However, it offers one advantage, and was therefore favourably considered. The *Bridegroom* has had her wheels altered to the plan of Mr. Chatterton's construction, which you have correctly enough described: I would just add, on that head, that the floats are so arranged that the same amount of propelling surface is continuously presented to the water, and in a straight line across the wheel, so that the resistance, being parallel to the shaft, is as direct as in the common wheel.

The results of the trial on Saturday last proved clearly that Mr. Stevens' wheel has an advantage over the common wheel, inasmuch as it obviates vibration, without any loss of propelling power, but that Mr. Chatterton's wheel possessed the same advantage, with a most decided gain in speed; that is to say, that his wheels have made the *Bridegroom* as fast a boat as the *Twilight*, which was previously upwards of a mile an hour faster!

COMMANDER SHULDHAM'S NEW YACHT RIG.

Sir,—The sketch and description of a new rig for yachts given by Commander Shuldham in your Magazine for January 17, lead me to the highest hopes that at length we are to advance a long step in this matter.

I wait with anxiety for his account of the performances of this little craft, because I rejoice to see how thoroughly he is alive to the defects of our sail-cutting system, and how satisfactorily they are remedied in that which he proposes.

The plan, however, is quite independent of "a revolving mast," and its principal feature lies in this, that the sail is kept flat, not by hauling in the sheet, but by an extension of the boom, which can then be used as a lever. There is no denying that such a sail is only a lug with a boom on deck; and looking at the sketch of this new rig, it is evident that by discarding the triangle, which a vertical from the bow-piece would cut off, we should get rid of considerable weight and lose but little canvass.

Supposing this rig to be applied to an ordinary mast, no doubt the head of the shrouds interferes with the gaff when the boat is going large; and if the gaff is to lie on one side of the mast, this interference would be greater than it is at present when jaws are used. Might not this evil be done away with by the following expedient? Make the head end of each shroud fast to a strong iron piece of a T-shape *inverted*, and make fast the long shank of the T (which might be 6 feet in length) to the mast-head. Thus all the space represented by each arm of the cross piece of this T-shaped iron would be gained on either side. What

Commander Shuldham proves so logically with respect to stay-sails when their luffs are at an acute angle with the horizon, may be gathered at once from observing how great an angle in azimuth must be made between the planes of jibs and foresails if both are set with taut sheets, and the vessel so steered as to prevent either of them shivering. This angle clearly measures the inferiority of the jib to the foresail, so far as relates to propulsion. Let Commander Shuldham persevere in his experiments; their results are hopefully looked for, and promise to be most important.

Yours, &c.

JOHN MACGREGOR.

Temple, January 25, 1852.

MASTERS AND MEN.*

The agitation which for some time past has been going on between masters and men, respecting the questions of overtime and piece-work, seems to be as vigorous as ever, nor is there any immediate prospect of a solution such as will be satisfactory to both parties; and we are afraid that, although each wears a determined front in the meantime, the question will ultimately be resolved, not by argument or by friendly mediation, but by the consideration of which can the longer avert ruin and starvation. The masters are strong in their sense of right, and believe they have such a perfect comprehension of the subject in all its bearings, that they do not want either counsel or assistance "All we want," say they, "is to be let alone. With less than that we shall not be satisfied; until we accomplish that, we shall not re-open our establishments." The operatives have a conviction, no less absolute, of the justice of their cause, and are determined, at least so far as present appearances go, to insist on every iota of their demands. They were so foolish, a short time ago, as to desire a reference of the points in dispute to a court of arbitration, with Lord Cranworth at its head; but a letter published by this eminent judge, enunciating the doctrine that employers and operatives should be free to enter into any contracts they please, without the intervention of a third party, has opened the eyes of the Amalgamated Society to the fact, that they alone are the judges of their own business; and that if the employers are "respectively the masters of their own establishments," the workmen are the masters of their own bones and muscles. Henceforth, we shall expect to hear little from the Amalgamated Society about an appeal to arbiters, unless it be to arbiters of whose decision they may have a pretty sure presentiment. Arbitration is a very good way of settling a dispute when there is any dubiety in the case, and when each party is ready, honestly and without reservation, to abide by the judgment of the arbiters; but if neither party is prepared to admit the possibility of their being wrong in even the slightest particular, arbitration between them can have no place. The masters, we think, have acted more consistently than the men, by repudiating arbitration altogether in this instance. "With every respect for noble and distinguished referees, whose arbitration has been tendered to us, and with no reason to doubt that their award would be honest, intelligent, and satisfactory (?) we must," say they, "take leave to say that *we* alone are the competent judges of our own business." They have, accordingly, in the exercise of their judgment, closed their establishments, and, having issued a "Representation" of their case for the enlightenment of the public, they now sit down with folded hands, determined to have a satisfactory solution of the problem—whether they or the workmen have the greatest power of endurance, and which party has least need of the other?

Not the least important and interesting circumstance connected with this quarrel, is the somewhat officious, though ostensibly benevolent offers, on the part of some of our aristocracy, to mediate between the opposing parties. Whatever may be the sentiment, however, which has influenced them to tender their good offices for the settlement of the present dispute, the masters have

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* "Representation of the Case of the Executive Committee of the Central Association of Employers of Operative Engineers, &c." Offices, 30, Bucklersbury.

"May I not do what I will with my own?" Considerations on the Present Contest between the Operative Engineers and their Employers. By E. VANSITTART NEALE, Esq. London: J. J. Bezer. 1852.

evinced a decided repugnance to their interference,—no doubt thinking, that if noblemen wish a channel for their outwelling benevolence, they can find it in some other department. Our aristocracy, they may very naturally suppose, are travelling beyond their proper limits when they presume to settle differences between employers of *engineers* and their workmen, and would be acting a more consistent, as well as a more truly benevolent part, were they to confine their regards, in the first instance, to the relations subsisting between the owners of capital in land and the miserable serfs who labour on the land at weekly wages of seven or eight shillings. There are reasons, however, sufficient to explain why sentimentalists like Lord Goderich and Mr. Vansittart Neale should prefer mixing themselves up in a dispute between employers and a body of workmen whose wages, on the average, have been 32*s.* or 33*s.* a week. The poor cultivators of the soil in Essex, Wiltshire, and other agricultural districts, have no organization or union; having no union, they can have no executive committee; having no executive committee, they cannot call large public meetings attended by newspaper reporters, and exhibiting a platform ornamented with a sprinkling of the aristocracy, who come forward as the pure and disinterested patrons of the working classes. The public generally, as well as the employers of engineers, may think Lord Goderich, and such as he, would be as well engaged in endeavouring to improve the physical and moral condition of the agricultural labourer, as it is a field of philanthropic exertion in which they might feel more at home, while the necessity for it is no less obvious; but then there would not be the same conspicuousness, nor the same rounds of cheers that greet them when they step on to the platform in St. Martin's-hall, at a meeting of operative engineers. The masters, we think, have very properly rejected the offers of mediation from such parties, and may justly "ignore the proposition that they should submit to arbitration the question, whether their own property is theirs, and whether they are entitled to be the masters of their own actions." There is, to be sure, the semblance of arrogance in the phrase they employ, "We claim to do what we like with our own;" and the absolute form in which they thereby assert their right will expose them to severe strictures in various quarters; but so long as they do what they like with their own, without trenching on the rights of others, their assertion of this right is undeniably just. They have a perfect right either to open their establishments, or shut them up as they please; and no one, without the exercise of an unwarrantable tyranny, can dictate to them the mode in which they shall employ their capital; for as they justly observe in the "Representation," if theirs is the capital, so are "its perils and its engagements." If, in the distribution of their capital, whether in wages, or plant, or tools, any one should feel dissatisfied, all he has a right to do, is to refuse the terms they offer.

It is the opinion of some that if arbitration should not be accepted, the Legislature should interfere, and by enactment settle the relative conditions of capital and labour. Now, in the case of women and of children of tender age, it may be all right to regulate by Act of Parliament the amount of labour they shall be permitted to undergo; but when the parties stand on so equal a footing as the members of the Central Association of Employers and the adherents of the Amalgamated Society, we cannot conceive of any interference on the part of the Legislature that would not be fraught with injustice towards one of the opposing forces. It is too much the fashion to point out labour as occupying a less advantageous ground than capital, when arranging mutually their terms. The workman has his capital as well as the employer. His strength and his skill constitute his capital; it is perfectly portable, and, unlike the capital of the employer, great part of which is fixed in buildings and machinery, he can carry it about with him wherever he goes. Nor is his capital subject to the same mutations as that of the employer. He may not, by this portable capital of his, have the same chance of rising to opulence; but, on the other hand, he can never, by the exercise of his capital, or, in other words, of his strength and skill, involve himself in bankruptcy and ruin, as is too often the case with those whose capital is fixed in buildings and machi-

nery. The workman never works for nothing; the employer often does, and sometimes even for less than nothing. And in determining the conditions that shall subsist between employers and their operatives, any one who takes a full and candid review of the various strikes effected by the latter within the last twenty-five years, will be satisfied that what we call portable or movable capital — that is, labour — has frequently (though not always) come off with advantage. With respect to the parties in the present dispute particularly, the operative engineers, dealing with their employers individually, seem to have known their advantage and to have improved it. "Our business," says the "Representation" of the Masters, "renders us more obnoxious to strikes than any other, and renders precautions against them more imperative. The heavy expense of our machinery and tools, and the peculiar character of the work we produce, render overtime, piece-work, and irregularity of employment an unavoidable and certain incident of our calling. We cannot, like the spinner, the weaver, or the cloth-worker, manufacture on speculation, and produce without order, certain that ultimately the article will be required, and must always be in demand. The same yarn will weave to any pattern, the same cloth will fit any coat: but we can only produce to order, and we must produce our commodity *when* it is ordered. Our customers require all their purchases for a special purpose, and at a particular time. Perhaps they are useless to them, unless supplied when stipulated — certainly they will cease to employ us, if we fail to finish to our time." The workmen know all this as well as their employers, and seem to have watched every opportunity of catching them in a "fix." "Short-sighted Unionists," says the 'Representation,' "aware that we work against time, some of us under actual penalties, all of us under peril of the loss of trade if we fail in punctuality, induce the men, when the master is in his greatest difficulty, to take advantage of his necessities to wring from him humiliating and unjust concessions, which leave him without profit, or threaten him with loss."

The "Representation" shows very satisfactorily the necessity for piece-work and for frequent over-time in large foundries and machine shops; and we are inclined to think that if over-time were a matter not of necessity, but of mere option on the part of the employers, their servants would not have a word to say against it. Were it mere whim or caprice that led an employer to ask his operatives to work a couple of hours longer, they would gladly avail themselves of the chance; but when he is compelled to have such a piece of work ready for his customer at a given day, under a penalty, then they feel that he is very much at their mercy; and, under cover of sickly cant about the cultivation of their minds, insist upon certain demands which they know the employer cannot then well refuse.

We are by no means prejudiced in behalf of the employers, and against the operatives. All we contend for is, that if the former often have the advantage over their men, by offering them low wages or the alternative of starvation; the latter no less frequently have their masters on the hip, and are quite as vigilant and shrewd in looking after their own interests. The fact is, they are well matched; and all the public have to do is to look on, and wait till the problem is solved, "Whether the union of the Employers or the union of the Operatives will the longer maintain its integrity."

Mr. Vansittart Neale's pamphlet is a plea for co-operative associations, such as have obtained in Paris to some extent since the Revolution of February, and such as partially exist in London. There is nothing new in the radical idea of a co-operative association, — it is as old as trade itself, and about as widely spread. Every company formed for the purposes of trade or manufacture is radically a co-operative association, although it consist only of two individuals; and when a particular business can be conducted more efficiently and profitably by co-operative associations, or by partnerships, they are generally to be desired. We can quite understand how two blacksmiths should club together their little savings for the purpose of taking premises, and purchasing plant and tools which would be too expensive for their means singly, and then work

together for their mutual advantage, under certain defined terms of agreement. But then, is it not natural that if a third party, also a blacksmith, should wish to join them, they should exercise their discretion, and consider—not his privileges as one who had served a legal apprenticeship to the trade—but whether his co-operation with them would be to their advantage? Should they reasonably be expected to allow that man to walk into their workshop, and commence to labour with them, without exercising the right either of admission or of exclusion? But this seems to be the sort of working association Mr. Neale advocates; and yet, in the cases he adduces to illustrate the harmonious and efficient working of co-operative associations, we see the same right of exclusion or admission exercised as is observed by masters towards their men. Speaking, for instance, of the Lamp-makers' Association in Paris, he says—"The prohibition of drunkenness is universal." Now, although we are no apologists for drunkenness, we think it very hard that, after a man has earned wages, he should not be allowed to spend it as he pleases. *We*, of course, would not employ an habitual drunkard; and most masters, we presume, would exercise the same right of exclusion. But it appears the Co-operative Association of Lamp-makers does the same—makes a *selection* of those who shall co-operate with them. It is not open to any journeyman lamp-maker in Paris to go into the shop of the Co-operative Association any more than into the shop of an individual master; he must, among other conditions required of him, be a teetotaller.

We, however, see nothing objectionable in men clubbing their efforts together, and dividing the proceeds amongst them. If they will thus find themselves better off, they have a perfect right to do it. If the Association of Journeymen Tailors, for example, get full employment, *get ready money from their customers*, and are never asked for credit, as master tailors are, and at the same time get an equal price with the masters, then we think they are in a remarkably advantageous position, and are to be envied by their fellow tradesmen. All we say is, that co-operative association for business purposes is nothing new, and that where it can be carried on efficiently and profitably, it is for the interest of the parties engaged. The great question is—not is it right, but is it wise? In any given business, will the associated members be better off than by working under masters? Will they get their weekly wages more regularly?—Will their managers or secretaries always be honest with them?—Will their work always be paid for in ready money?—and, Will the public patronize them as readily as individual masters? These are questions which the operatives are bound to consider; and if they can answer them in the affirmative, then the sooner they form themselves into working associations the better. From what we know of co-operative associations such as Mr. Neale recommends, we should be inclined to answer these questions in the negative. Their whole past history satisfies us that the members have invariably been the dupes of designing knavery and the victims of incompetent management. It is impossible for us to predict what their future history may be; but surely those parties who, like Lord Goderich and Mr. Neale, are bolstering up the operatives against their employers, and leading them into the mazes and labyrinths of the co-operative system as it is expounded in Mr. Neale's pamphlet, are incurring a tremendous responsibility. This pamphlet of Mr. Neale's, by-the-bye, we observe has been printed by a co-operative association of printers. A few copies were circulated at a meeting of the Amalgamated Society of Engineers, held in St. Martin's-hall, on Monday last; and it was then announced that any additional copies might be had that afternoon at the publishers. This was on Monday; but not a copy could be got at the publishers' till Wednesday afternoon, at four o'clock, although it was eagerly sought after by hundreds. Now we do not wish to say anything harsh respecting the co-operative printers of Johnson's-court; no doubt they repudiate overtime and piece-work, and conduct their business with a determination not to overtask their energies, and so as to leave themselves plenty of time to cultivate their minds and enjoy the amenities of life. Besides, "What is everybody's business, is nobody's;" the one compositor is just as responsible as the other for any delay in executing their customers' orders: hence the responsibility, being so diffused, is scarcely ap-

preciated by them individually. Mr. Vansittart Neale, we should think, must have felt, with all his predilections in favour of working associations, that, in this case at least, there was the want of a master,—of one to whom the operatives should be individually responsible, while he, in his turn, should be responsible to his customer.

PROJECTED AMERICAN CRYSTAL PALACE.

(*From the "Scientific American."*)

A short time since, Mr. Riddle, the United States Commissioner to the World's Fair, and some others, petitioned the Common Council of New York, for permission to erect in Madison-square, in that city, a building of iron and glass 600 feet long and 200 feet wide, for an Industrial Exhibition of all nations. The petition was referred to a special committee, which reported favorably on the subject, and afterwards the following resolution was adopted :—

"Resolved, That the free use and sole occupation of Madison-square be, and the same is hereby granted to Edward Riddle and his associates, for the term of two years from the date of the adoption of this resolution, whereon to erect a building of iron and glass, for the purpose of an Industrial Exhibition of all nations, in pursuance of the petition annexed, provided that said Riddle and his associates will enter at once into an agreement with sureties, with the City, through the Controller, that they will, during said time, erect around said square, at their own cost and expense, and at the cost of not less than six thousand dollars, under the superintendence of the street-commissioner, a good, strong, handsome and sufficient iron railing with the necessary gates, &c., similar to the railing around Washington Parade-ground, or of a pattern to be approved by the street-commissioner, which shall be the property of the Corporation after the expiration of the said term hereby granted, and to restore said ground to its present condition, and to take every means to preserve the trees, &c., therein, and provided also that the price for admission to said building for individuals shall at no time exceed 50 cents."

Some of the members of the Board of Aldermen—Alderman Miller and Shaw—boldly and sensibly opposed the measure; they thought it should be a government project, national and great in character, and one to which the world should be invited. The action of the Common Council we hold to be foolish and flagrant. If the project is carried out as proposed, it will disgrace us in the eyes of the whole world. Here, in our great Republic of 24,000,000 inhabitants, we are to have a World's Fair directly on the heels of the London one—and such a Fair, a small and ridiculous copy of the Crystal Palace. The fact is, a lot of speculators who have not souls for their country above buttons, intend to make a fine speculation out of such an affair. It is evident that the glory of their country is measured by three cent. pieces, and the price of andirons. We want no such exhibition in this city, nor in our country. We would rejoice and be glad if a World's Fair, broad and national, not under the management of auctioneers and stock-jobbers, would be held in our country. We should like such an affair to be great and grand, and superior, if possible to the London Fair,—but this small-potato contemplated Crystal Palace, will make us the laughing-stock of all nations. The Common Council had no business to make such a grant as it has done to a private individual or individuals, and it should not have made it. The project is one worthy of pedlars without national pride; and if this was the spirit which managed our department at the World's Fair, we cannot feel too deeply for the fame of our Republic. The matter, however, is not finally settled. The new Corporation will probably annul the grant, as they should do. It is a shame to find men under the guise of a kind of patriotism, endeavouring to make money out of public exhibitions, personally all for themselves, but professedly all for the public. The Crystal Palace, in London, was 1800 feet long; when America builds one for a World's Fair, it must be one or two hundred feet longer, not our miserable squirrel-cage of 600 feet, only one-third that of the one in Hyde Park.

When speaking of this affair again, if we have to do it, we must call it Riddle and Co.'s Fair, not the "American," nor the "World's Fair." When we have a World's Fair, we don't want the building to be a slavish copy after Paxton's, but a new and original design.

TRIAL TRIP OF THE WEST INDIA STEAM-SHIP "ORINOCO."

Southampton, Jan. 25th.

The royal mail steamship *Orinoco* arrived from the Thames this afternoon, having left Blackwall on Friday, shortly after noon.

The *Orinoco* is the second ship of the new West India line, of which the unfortunate *Amazon* was the pioneer.

The *Orinoco* was built at Northfleet (in company with the *Magdalena*, the third

vessel of the same class for the West India service), by Mr. Pitcher, and the engines are from the celebrated factory of Messrs. Maudslay, Sons, and Field.

Before giving an account of the performances of the *Orinoco*, and her admirable behaviour in a tremendous gale which she encountered in the Channel during the whole of Saturday night, a short description of the vessel is necessary.

Externally, the *Orinoco* very much resembles the *Amazon*, her great length, lofty rig, immense spread of canvas, and low funnels, giving her the appearance of a steam-frigate of the largest class, and not of a mere merchant steamer. She has been pronounced capable of being armed with 26 guns, four of which, on the main deck, might be 10-inch Paixhan long-range guns, of the heaviest size; the remainder short 32 or 24-pounders, as the case may be. Upon an emergency, a couple of long 68-pounders, on traversing slide carriages, might be fitted to the spar deck, if that deck were temporarily strengthened by a few additional supports for the purpose.

The dimensions of this noble ship are as follows:—Length between the perpendiculars, 270 feet; length over all (figure head to taffrail), 301 feet; length on spar deck, 276½ feet; breadth from out to out of paddle-boxes, 71 feet 10 inches: extreme breadth, 41 feet 10 inches; ditto for tonnage to a six-inch bottom, 41½ feet; breadth moulded, 40½ feet; depth of engine-room at shaft, 26 feet 1 inch; depth from underside of spar deck, 33½ feet; burden in tons, builder's measurement, 2,245 31-94ths.

The *Orinoco*, like the *Amazon*, has nine boats, four of which are Lamb's Patent Life-boats, 30 feet long and 8 feet wide, and calculated to carry 32 persons each. Two are swung forward over the fore sponson, and two over the after sponson. There are also two large cutters, 27 feet long with 8 feet beam, each boat calculated to carry 35 persons, and pulled by 12 oars each. Besides this, there is one mail-boat, 22 feet long, 6 feet beam, able to carry 18 people; a gig, 25 feet long, 5 feet beam, able to contain 10 persons; and a dingy (rather larger than that supplied to the *Amazon*), being 17 feet long and 5½ feet wide, and calculated to carry 8 or 9 people. These nine boats would be sufficient to provide for the safety of 234 persons.

The *Orinoco* is propelled by two engines, made by Messrs. Maudslay, Sons, and Field, of London, which are of the nominal aggregate power of 800 horses. These engines are on the patent double cylinder direct acting principle, and embrace all the most recent improvements applied to marine steam machinery. Each of the four cylinders is of 68 inches diameter, and, calculating the surface area of the pistons, are supposed to be equal to two 98 inch cylinders, such as are supplied to the ordinary side lever marine engines; and the boilers are eight in number, each boiler having three furnaces, and possess an aggregate evaporating power of 9,000 gallons of water per hour; the paddle-wheels, 40 feet in diameter, are fitted with the patent feathering floats, which have been found so efficient and successful in their operation when applied to other steamers of this line.

The whole of the machinery performed most admirably throughout the run from the Thames, and the bearings, which are generally found to heat during the first trials of steam machinery, remained perfectly cool. It is almost needless to say that the *Orinoco's* engines were generally admired, not only for the finish and beauty of the workmanship bestowed on them, but for the general perfection of their arrangements, and for the smoothness and freedom from all unpleasant motion and vibration, even when the ship was steaming at full power against a heavy head sea and in a gale of wind. The ventilation of the engine-room has also been so carefully provided for, that the temperature was most pleasant, compared with the high temperature of the engine department in many, and indeed most other steam-vessels. We may also add, that from the time of getting under weigh at the Nore until arriving in Southampton Water, the engines were not stopped for a single moment, excepting to take a pilot off the Nab, and on another occasion to readjust one of the paddle-floats.

Draught of water aft, 17 feet 9 inches; forward, 17 feet 6 inches; when leaving Blackwall having 400 tons of coals on board. It is calculated that with 1,100 tons of coals, and with cargo and stores all ready for sea, the *Orinoco* will have a draught of water of 21 feet on an even keel.

The magazine of the ship is fitted in a lead tank, and may, in the event of fire, be immediately flooded with water from a pipe leading from the spar deck.

The *Orinoco* started from Blackwall at 1·30 p.m. on Friday. Two trials of her speed were made in Long Reach, on the first against the last of the flood tides; and, tested on both sides at the measured mile, the distance was performed in 5 minutes, 10 seconds, equal to a speed of 11·613 knots, about 12½ statute miles per hour, the engines making 13 revolutions with a pressure of 12 lbs. of steam in the boilers. A second trial gave a result of 5 minutes, 33 seconds, equal to 10·811 knots, to which was added the influence of the tide, equal to half a knot, making a total of 11·311 knots.

After remaining a short time off Gravesend, the *Orinoco* proceeded to the Nore, where she anchored for the night, performing the run thence, a distance of 23 miles, against a four-knot tide, in 1 hour 23 minutes, the engines making 13½ revolutions, the speed by Massey's Log, when added to the adverse influence of the tide, giving a speed of nearly 12 knots, equal to 13·5 miles per hour.

* * * *

On shoving out round the South Foreland the gale was at its height. The best proof of its severity is this, that, though the engines were working up to 1,600-horse power, the *Orinoco* was eight hours in going from off Dover to off Dungeness—a distance of about 16 miles. At seven, Beechy-head was sighted N. by E., and in a few hours the steamer was in smooth water, having perfectly satisfied every person on board that a safer, easier sea-boat could not be found in the world, and that she may be reckoned as presenting the highest combination of the unrivalled skill in naval architecture and engineering in which this country excels.—*Abridged from the Times.*

ELECTRIC TELEGRAPH IN PIEDMONT.

(Translated from the "Gazzetta Piedmontese" for the "Mech. Mag.")

Among the many improvements that are in progress in that happy part of Italy, which alone has maintained its free institutions against all attacks from within and without—namely, Piedmont—the telegraphic establishment is conspicuous. A network of telegraphic lines will soon be spread over the whole kingdom, for the use of the public at large; and the best methods appear to have been adopted to combine economy in the construction, with efficiency in the service. But the line between Turin and Genoa, which has been already completed, has a peculiar feature which calls for some remarks. From Turin to Arquata the suspended wires follow the railroad; but from the latter place to Genoa, a chain of the Apennines intervenes, and there the real difficulties begin. Mountains have to be bored, long tunnels constructed, deep ravine filled, and viaducts and bridges erected, before the railroad between Arquata and Genoa can be finished. Meanwhile an immediate establishment of a telegraphic communication with Genoa being urgently wanted, the engineer Bouelli, Director of the Electric Telegraphs, in Piedmont, has adopted a bold and novel expedient by which he has successfully overcome all difficulties. He has thrown and suspended his wires from mountain to mountain at immense altitudes, and in straight lines, riding over deep ravines and valleys, without any intermediate supports, the poles being fixed on the summits at distances varying from 800 to 1,300 yards apart; occasionally, and when local circumstances require it, as in passing through villages and towns, the line is continued under ground, out of which emerging, and again meeting with high mountains, its resumes its flight in the shape of a wire bridge from crest to crest; this again sinks under ground to travel below the streets of Genoa, till it reaches the station in the Ducal Palace. This picturesque line of telegraph is so well arranged, and the isolation of its wires is so perfect, that, notwithstanding the adverse circumstances presented by nature, it has been at work daily and nightly during the worst part of the winter, and has constantly been the ready and faithful messenger of the incessant movements of the operator's hand.

The French engineers had hitherto boasted of their successful adoption of long distances between the poles of suspended wires, and their *chef-d'œuvre* of the kind is the line between the *Passage Jouffroy*, in Paris, and the Palace of the Assembly, in which the greatest length of unsupported wire is 600 metres (equal to about 650 yards). But in the Sardinian line, which forms the subject of our remarks, the same principle has been successfully and repeatedly carried to double that extent, under much more unfavourable circumstances.

The engineer, Bouelli, is a gentleman who, to high scientific attainments, unites a long practice of telegraphic engineering acquired in this country.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JANUARY 28, 1852.

Thomas, Earl of Dundonald, Admiral in the Royal Navy, late of Chesterfield-street, but now of Belgrave-road. *For improvements in the construction and manufacture of sewers, drains, water-ways, pipes, reservoirs, and receptacles for liquids or solids, and for the making of columns, pillars, capitals, pedestals, vases, and other useful and ornamental objects, from a substance never heretofore employed for such manufactures.* Patent dated July 22, 1851.

The new material proposed to be employed for the various purposes enumerated in the title is the bitumen, petroleum, or natural pitch of Trinidad and the British North American Colonies. Of this substance there are several different varieties, it being found more or less indurated and elastic in different situations. According to the character of the article to be produced, and the nature of the use to which it is to be applied, so must a hard or soft, elastic or non-elastic bitumen be selected. The articles are formed by running the bitumen in a melted state into suitable moulds, using a core as may be required, and care must be taken that the mould and core are covered with clay, black lead or some other substance, which is capable of preventing the bitumen from adhering to the same. When casting pipes for the conveyance of liquids, it is preferred that they should be flattened on one side, to enable them to remain firm and steady in the position they may be intended to occupy. Instead of casting pipes, they may be manufactured by bending strips of sheet bitumen around a core, and then melting together the abutting edges, or running liquid bitumen in between them. For the purpose of lining cisterns and such like receptacles, sheets of bitumen are prepared by rolling or pressing out lumps of that substance, and the meeting edges of the sheets are to be united together by melting or by the use of liquefied bitumen. Sheets of textile fabrics of a loose and open texture may be also coated, on one or both sides, with bitumen; to facilitate which operation, they should be previously saturated or paid over with liquid bitumen, or bitumen dissolved in naphtha. These sheets are very suitable for being used to cover ships' bottoms, between the planking and the metallic sheathing; and they are also adapted for other uses where substances impervious to wet, and almost indestructible, are required.

Another application of bitumen is for the purpose of covering electric telegraph wires. The wires may be either covered separately (and when this is done, it is preferred to enclose the wire previously with some filamentous material saturated with liquefied bitumen), or a rope having been covered with bitumen, and longitudinal grooves left in the coating for the wires to fall into, they are laid in the grooves, and the whole covered with another coating of bituminous material.

The inferior descriptions of the same material may be also employed for consolidating rolling gravel, forming foundations, or supporting those in a falling condition, lining sewers, water-ways, &c.; and its application is suggested in the colonies for lining the beds of the copious streams which flow from the mountainous districts during certain seasons, for the purpose of conducting the water, which otherwise generally runs to waste, or is absorbed in the bed of the river, to situations where its fertilizing influences will be most beneficially applicable. The bitumen lining may be applied by covering the surface of the bed of the river with the material, and then fusing it by burning brushwood, which is to be spread over for that purpose.

Arthur Field, of Lambeth, gentleman. *For improvements in the manufacture of candles, night-lights, and mortars.* Patent dated July 22, 1851.

The present improvements consist—

1. In constructing candle-moulds of plaster of Paris, Roman cement, Keene's cement, Portland cement, clay, or other similar substance, in two or more parts; and in forming metal moulds in the same manner, only that in this case the parts of the mould are hinged together. The method of using moulds of this description needs no further explanation when it is remarked that the candles are removed by lifting them from the mould, instead of drawing them out, as is done with ordinary moulds.

2. In forming the wick-supporters, used in manufacturing mortars and night-lights, of plaster of Paris, Roman cement, Keene's cement, Portland cement, clay, or other similar substance. These supporters are used in the same way as those composed of metal.

3. In manufacturing the cases or envelopes of night-lights from gelatine, alone or mixed with gums soluble in water, or with gum resins soluble in spirits of wine or alkaline solutions, or with both, instead of making them of paper, in the usual manner. The night lights are moulded and wicked as customary, and either thrust into the gelatine cases, or the cases are turned inside out and turned back over the night-lights. These lights are superior to those with paper cases, inasmuch as their light is more equably and agreeably diffused, instead of being concentrated in a single spot; and they also burn longer, as the gelatine cases being impervious to fatty matters, prevent their escaping to waste.

Specification Due, but not Enrolled.

Samuel Varley, of Sheffield, engineer. *For improvements in retarding and stopping railway carriages, and in making communications between the guards and engine-drivers on railways.* Patent dated July 22, 1851.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Thomas Richardson, of Newcastle-upon-Tyne, for improvements in the manufacture of magnesia and some of its salts. January 23; six months.

George Stacey, of Uxbridge, Middlesex, machinist, for certain improvements in machinery for reaping, mowing, and delivering dry or green crops. January 24; six months.

William Pidding, of the Strand, Middlesex, gentleman, for improvements in the manufacture, preparation, and combination of materials or substances for the production of fuel, and for other useful purposes to which natural coal can be applied. January 24; six months.

Joseph Jones, of Bilston, Stafford, furnace-builder, for an improvement or improvements in furnaces used in the manufacture of iron. January 24; six months.

Richard Ford Sturges, of Birmingham, Warwick, manufacturer, for an improved method or improved methods of ornamenting metallic surfaces. January 24; six months.

John Hinks, of Birmingham, manufacturer, and Eugene Nicolle, of Birmingham aforesaid, civil engineer, for certain improved machinery to be used in the manufacture of nails, rivets, bolts or pins, and screw-blanks. January 24; six months.

Peter Armand Lecomte de Fontainemoreau, of South-street, Finsbury, for certain improvements in lithographic, typographic, and other printing-presses, which improvements are also applicable, with certain modifications, to extracting saccharine, oleagineous, and other matters, and to compressing in general. (Being a communication.) January 24; six months.

James Gathercole, of Eltham, Kent, envelope-manufacturer, for improvements in the manufacture and ornamenting of envelopes, parts of which improvements are applicable to other descriptions of stationery; and in the machinery, apparatus, or means to be used therein. January 24; six months.

Arad Woodworth, and Samuel Mower, of Massachusetts, United States, for certain new and useful improvements in machinery for manufacturing bricks, tiles, or other articles of a similar character. January 24; six months.

Alfred Richard Corpe, of Kensington, Middlesex, gentleman, for improvements in trouser-strap fasteners. January 24; six months.

George Kent, of the Strand, for certain improvements in apparatus for sifting cinders, and in apparatus for cleaning knives. January 24; six months.

Joseph Maudslay, of the firm of Maudslay, Sons, and Field, of Lambeth, Surrey, engineers, for improvements in steam engines, which are also applicable, wholly or in part, to pumps and other motive machines. January 26; six months.

Edward Simons, of Birmingham, tallow-chandler, for certain improvements in lighting. January 27; six months.

William Brindley, of Queenhithe, for improvements in the manufacture of flocked fabrics and in the manufacture of buttons. January 27; six months.

William Dray, of Swan-lane, Upper Thames-street, London, agricultural implement maker, for improvements in reaping machines. (Being a communication.) January 27; six months.

George Duncan, of the New North-rod, Hoxton, and Arthur Hutton, of Herbert-street, New North-road, Hoxton, for improvements in the manufacture of casks. January 27; six months.

Nelson Smith, of New York, United States, gentleman, for improvements in the construction of violins, and other similar stringed musical instruments. (Being a communication.) January 27; six months.

Jean Benjamin Coquatrix, of Lyons, France, merchant, for improved apparatus for lubricating machinery. January 27; six months.

James Joseph Brunet, of the Canal Iron-works, Poplar, Middlesex, engineer, for certain improved combinations of materials in ship-building. (Being a communication.) January 27; six months.

Alexander Mills Dix, of Salford, brewer, for certain improvements in the method of ventilating apartments or buildings, and in the apparatus connected therewith. January 27; six months.

Thomas Lambert, of Hampstead-road, Middlesex, piano-forte manufacturer, for certain improvements in piano-fortes. January 27; six months.

Julian Bernard, of Guildford-street, Russell-square, Middlesex, gentleman, for improvements in the manufacture or production of boots and shoes, and in materials, machinery, and apparatus connected therewith. January 27; six months.

Joseph Vincent Melchior Raymondi, of Paris, France, machinist, for certain improved statistic and descriptive maps. January 27; six months.

Isaac Lewis Pulvermacher, of Vienna, engineer, for improvements in galvano-electric, magneto-electric, and electro-magnetic apparatus, and in the application thereof to lighting, telegraphic, and motive purposes. January 29; six months.

François Jules Manceaux, of Paris, France, gun-manufacturer, for improvements in fire-arms, and in instruments and apparatus used in connection therewith. January 29; six months.

Isham Baggs, of Liverpool-street, Middlesex, electrical engineer, for improvements in crushing gold quartz and metallic ores. January 29; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Jan 22	3090	George P. Cooper	Suffolk-street, Pall-mall	Elliptic gusset.
28	3091	W. C. Wright	South-quay, Regent's-canal Dock	Machine for screening coals.
,,	3092	Brierley and Son	Cheapside, Halifax	Fastening for braces, &c.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London— Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburg.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1487.] SATURDAY, FEBRUARY 7, 1852. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

MITCHELL'S HYDRAULIC ENGINE.

HISTORICAL NOTICE OF THE INTRODUCTION OF MACHINERY INTO THE ENGLISH DOCKYARDS, AND DESCRIPTION OF HYDRAULIC ENGINE FOR WORKING THE SAME, INVENTED BY MR. J. MITCHELL, LATE ENGINEER OF SHEERNESS DOCKYARD.

Mr. Mitchell, many years the Engineer of Sheerness Dockyard, being probably the only living scientific witness of the first introduction into naval arsenals of machinery for working wood, he was requested a twelvemonth ago to furnish information on the subject. In the course of the consequent correspondence it was indicated that he had, about forty years ago, invented a hydraulic machine for utilising the water delivered at the gate of Plymouth Dockyard; a drawing and description of that machine was thereupon requested, as also permission to send it for insertion in the *Mechanics' Magazine;* that permission has been granted, and the accompanying sketch furnished.

As Mr. Mitchell's letters have afforded particulars not elsewhere recorded, respecting Sir Samuel Bentham's machines for shaping wood, some parts of those letters may not be deemed uninteresting to many readers of the Magazine, as proving that several inventions specified in his patents were, half a century ago, in actual use both in Portsmouth and Plymouth Dockyards, affording examples which, in private hands, have so much contributed to the perfection and cheapness of the manufacture of that material.

Mr. Mitchell's first note on the subject, January 3, 1851, was in reply to a request that he would say which of Sir Samuel's machines were inspected by the Lords of the Admiralty on their visitation, 1802. Mr. Mitchell said, "the Lords of the Admiralty visited Portsmouth-yard in 1802, but I did not go there till January 8, 1803; however, I heard the circumstance frequently referred to, and the machines spoken of, particularly one for *sash-bars;* there were also machines for ploughing deals, and for cutting *curved* or *twisted* wood-work."

Thus it appears that a machine of late introduced to our naval arsenals for sawing curved work as a new invention, not only had been patented, but actually existed in Portsmouth-yard at least fifty years ago.*

On January 8th, 1851, Mr. Mitchell farther wrote as follows:—"Since my letter respecting the introduction of machinery by Sir Samuel into the Dockyards, and of his sash-machine, &c., &c., some recollections have come forcibly into my mind with respect to Plymouth-yard which you might not deem unimportant as to the sash-bar and sawing-machine. When I first went to Plymouth, in 1810, to superintend the making of the reservoir, and laying down the water-pipes, I was called upon by the officers of the yard to survey and report upon a considerable quantity of machinery and millwrights' work that had been laying in store for some years, sent by General Bentham, "to be erected, but from some misunderstanding of the Navy Board's orders, or some other cause, the Commissioner would not allow the work to proceed, and some of the machinery had been taken away. However, there were some very excellent machines set up in the turner's shop, then under the master house carpenter, viz., turning lathes, coaking-machines, and machines for making treenails, screw-cutting, &c. There were other machines spoken of, that were to have been for the joiners and house-carpenters in a building contiguous; but this being stopped, the machines were either returned or not sent. About that time, being the heat of the war, and all departments much pressed in preparing the work for the shipping, perhaps none more so than the joiners, I have often heard Mr. Hayward, the master-joiner, and Mr. Bills, the master house-carpenter, express themselves as to the usefulness these machines would be of to them for fowarding the work; they were called 'General Bentham's Sash-bar and Sawing-machines.' Now it appears to me that they must either have been promised or spoken of by some authority, or they must have heard of them by Mr. Burr†, who had been there with the machinery when first sent down. Before that machinery was sent down, there was no other for turning but a pole lathe.

* For a former notice of this machinery, see *Mech. Mag.*, vol. xlix., p. 590.

† "Mr. Burr had been trained by Sir Samuel in the use of his machinery in Queen-square Place, was, by Lord Spencer's desire, retained in the Inspector-general's Office for the purpose of introducing it, was sent to Plymouth to set some small machines to work there, and was on the establishment of the Wood-mills at Portsmouth, appointed master of them."

"In consequence of the driving machinery and building not being allowed to be erected, all the machines were worked by manual labour; therefore, in 1812-13, I contrived an engine to be worked by the pressure of water acting in a cylinder on a piston on the upper and under side alternately: these would have been 1,400 tons, with a pressure of fifty feet, which would have afforded power to work all the machinery with a considerable addition; it was highly approved, and recommended by the master shipwright to the Navy Board to be adopted, but was rejected through the influence of a certain member of the Board. In 1815, Commissioner Shield and the officers again proposed it to the Board, but I had the mortification to have an answer, saying it was not required!

"I had never heard of the power of water being applied in this mode, but a few years since heard of it as quite a new invention, and lately have heard of it being used in many instances with great effect. Believe me to remain, &c.,

"J. MITCHELL."

At the period referred to by Mr. Mitchell, the principal naval authorities listened only to the proposals of *private* engineers. They had just succeeded in obtaining the final abolition of Sir Samuel's last office; under such circumstances it could not be expected that any invention of Mr. Mitchell's should be adopted. The Inspector-general had, so early as the year 1797, proposed the taking advantage for working his machinery, of the great height at which water was delivered at the Dockyard gate at Plymouth; but on account of the egregious evasions of the Water Company's agreement with the Navy Board, he could not ascertain the quantity that would be delivered; his often-repeated official remonstrances could not induce that Board to appoint the surveyor stipulated for, so that, for instance, amongst other evasions, instead of a pipe delivering water from a full bore of 6 inches, the Company had laid down two pipes of 3 inches bore each, conceiving that as three and three make six, the authorities might be satisfied, though the quantity of water so delivered was in fact but half of that which would flow through one pipe of 6 inches bore; indeed the Navy Board were satisfied,—such was the state of physical science and of engineering knowledge at that time, both of the Board itself, and, generally speaking, of the Dockyard officers, their subordinates. Even the Comptroller of the Navy, in the year 1800, *officially* objected to Sir Samuel's proposal of establishing in each naval arsenal an officer versed in the principles of mechanical science; and it was not till the year 1805 that he succeeded in the introduction of such a person, under the humble title of master millwright, in one of his three Portsmouth establishments.

But to return to the Hydraulic Machine. It was not till 1810 that a surveyor having been at last appointed, the quantity of water to be delivered could be ascertained, or the water and fire-extinguishing works at Plymouth-yard be determined on, and then it was that Sir Samuel selected Mr. Mitchell for the superintendence of their construction. That gentleman's proposal of the hydraulic machine was at the time when Sir Samuel's office had been very lately abolished. Mr. Mitchell's note describing his hydraulic apparatus, is as follows:

"As much has of late been said respecting the economy of water power, I beg to send you a drawing and description of the hydraulic engine, invented and proposed by me in 1813, for driving turning-lathes, screw-cutting, sawing, and other machinery in Plymouth Dockyard, which had been introduced some years previously by Sir Samuel Bentham, and intended to be driven by a water-wheel, but for some cause that with a considerable portion of the machinery had not been erected; the only power then was that of manual labour.

"This engine was stated to be capable of the power of eight horses, and to be supplied from the water-pipes then laying down in that yard; that by opening and shutting a stop-cock in the supply-pipe, and by shifting the driving gear, the water and power could be economized, so as to range from the power of one man to that of eight horses—ample for a considerable quantity of additional machinery; but so difficult was it at that time to introduce machinery into Government service, that the proposal was rejected on most trivial grounds. It was again brought forward and proposed in 1817, with the reply, in answer to former objections, that it was intended to be constructed in part of old materials, and by workmen of the Dock-

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yard; but although highly recommended by some of the principal officers of that Dockyard, it was refused by a higher authority, alleging that it was not required.

"*Description of the drawing.*

"A, stop-cock on the supply-pipe, by which the quantity of water and the power of the engine is regulated.

"B, quarterly-cock, by which the water enters and escapes above and below the piston.

"RR, rod, fixed on piston-rod, and by which the quarterly-cock is opened and shut at each stroke of the piston. I am, &c.,

"J. MITCHELL.

"January 8th, 1852."

Amongst the above-mentioned old materials was the wheel shown in the drawing as it then was found in store in the Dockyard. Mr. Mitchell's claim to priority of this invention is verified by the official correspondence on the subject.

M. S. B.

THE MASTERS' SCHEME OF AN OPERATIVE BENEFIT SOCIETY.

It appears, in the *Times* of the 30th ult., that the Central Association of Employers of Operative Engineers have it in contemplation to establish a "new, sound, and legitimate benefit society." Should a Committee be appointed to draw up rules and regulations for such a society, the case of *convalescents* would doubtless be considered, as in many existing benefit societies the members of it are not permitted to engage in any money-getting employment whatever, so long as they receive allowances on account of illness. In such societies perhaps it is a rule essentially necessary for the prevention of abuse; but in large manufactories, a hint might be taken from Sir Samuel Bentham's regulations for the management of his three Portsmouth establishments; they have been described by himself as follows:

"In certain cases of hurts, besides the allowance of a half-day's pay, which I adopted according to the usage in regard to all the artificers in the Dockyard, I allowed, as an encouragement to industry, a convalescent, if permitted by the surgeon, to work, provided it were by the *piece*, at any work he may be able, and to receive, in addition to his half-day's pay, a payment for his piece-work at half the established rate."

This would, of course, require considerable modification in adapting it to a benefit society. What at Portsmouth was limited to hurts, would need to be extended to convalescence from disease: the allowance in illness and convalescence from it would not be a half day's pay, but the sum that might be fixed upon by the contemplated benefit society.

The above-quoted regulation was found to work admirably well at Portsmouth in every respect, but was particularly advantageous to the operatives in point of health; they came to the works, instead of going to the ale-house; and, little as their earnings might be, the habit of industry was maintained, instead of being destroyed,—not to speak of the injurious influence on morals so often consequent on the bad example which the publicans' house affords.

M. S. B.

Apprenticeship.

What is apprenticeship?—A contrivance by which moneyless youths are enabled to obtain instruction.

This purpose is effected by bargain between master and apprentice, the master to afford instruction, the pupil in return engaging to give his labour for a stipulated term—three, four, and in many cases seven years.

This equitable and desirable arrangement has led to, but in nowise sanctions, the great abuses called customs of trade; they are not supported by either law or reason.

The labour or other services of an apprentice not being always an adequate compensation to the teacher, in such cases money premiums, from *5l.* to *500l.*, or more, are added to the years of labour stipulated for by the master for his profit.

Masters will take clever youths at lower premiums than they will accept with dull or idle ones. Which workman would be preferred by the manufacturer, he who had needed seven years to learn his trade, or he who had acquired it in as many days?

ON MR. C. W. SIEMENS' REGENERATIVE CONDENSER FOR HIGH-PRESSURE AND LOW-PRESSURE STEAM ENGINES.

(Concluded from page 86.)

The advantages attending the application of the regenerative condenser to stationary engines being practically proved, the author is desirous to extend the same also to that important class, the locomotive engine. In inviting the attention of railway engineers to this inquiry, he is prepared for practical objections being raised, on account of the great rapidity of motion, the necessity for the greatest possible simplicity and lightness, the deficiency of condensing water, &c.; but he thinks that the condenser under consideration is peculiarly well adapted to meet these objections.

Its peculiarities in this respect are:—That it may be accommodated to any speed of piston, by reducing the length and increasing the breadth of plates; thus reducing the velocity of the displacing piston proportionately.

Its dimensions are proportionate to the capacity of cylinder only, and not (like other condensers) to the horse-power of the engine.

The total weight of a pair of condensers, as applied to a locomotive engine with cylinders of 13 inches diameter and 20 inches stroke, is about 3½ cwt.

The power of the blast remains nearly undiminished.

The condenser requires no attention in working the engine, and in case it should fail to act, from any accidental cause, the engine will continue to work high-pressure as usual; moreover, it does not interfere with the working parts of the engine.

The advantages which would result from a vacuum in the cylinder of a locomotive engine, have been ably set forth by Mr. Edward Woods, in his "Observations on the Consumption of Fuel and Evaporation of Water in Locomotive and other Steam Engines."—The present paper may therefore be limited to the means proposed for that purpose.

The two condensers are cast in one piece, and placed immediately in front of the cylinders of the engine. Each of them closely resembles the condensers above described: only the length of the plates, and the stroke of the displacing pistons, are much reduced in proportion to the steam cylinder, in order that the velocity of the water between the plates may not exceed certain limits.

The two displacing pistons are connected to opposite ends of a short vibrating beam, which receives its motion from the engine.

In addition to the exhaust valves leading into the hot-well, these condensers are provided with a second set of discharge valves, of a somewhat peculiar construction, which, with very limited motion, combine the advantage of opening a perfectly clear passage for the exhaust steam of the engine into the chimney, where its remaining expansive force is required to produce draught. This valve consists of a longitudinal rectangular slot, in the upper wall of the steam passage which leads from the cylinder to the condenser. At the ends of the slots are triangular pieces, which support the sides of two longitudinal lips which cover the aperture, except at such times when a superior pressure from within forces them open. The extent of their motion is limited by dead stops.

The escape of steam, together with the hot water into the hot-well, is regulated by a blow-off valve from the latter into the atmosphere; by this means a pressure above that of the atmosphere is obtained in the hot-well, which acts favourably in forcing the boiling-hot condensing water into the feed-pump of the boiler. It has been stated above, that the ordinary supply of feed water is of itself not quite half sufficient to maintain a vacuum within the condenser, and an additional supply of water must be provided for. Considering, however, the smallness of the excess of condensing water, especially if the diameters of the working cylinders are reduced

in proportion to the additional effective power gained, and considering that boiling-hot water will readily part with the principal portion of its heat, it is proposed to take it back to the tender through a simple refrigerator, in which advantage is taken of the rapid motion of the engine through the air for cooling the water. The refrigerator may be placed conveniently on the back of the tender.

The application of the proposed condenser to low-pressure engines (see fig. 2), requires but a short notice, after what has been said already; the letters refer to the same parts as in the former description of the high-pressure condenser, shown in fig. 1. In it the steam, at the time when it is released from the cylinder, has not sufficient force to expel the air and heated water from the condenser into the atmosphere, and a partially vacuous space must be provided for their reception. For this purpose, that side, B, of the displacing cylinder which, in the arrangement hitherto described, is always empty, is put in communication with the exhaust valve G, of the condenser, and receives the charge of water and air at the time when the piston is at the opposite end. A second valve O, is provided, through which the water is expelled into the hot-well during the return of the piston. For the convenience of arrangement, the displacing cylinder is reversed.

The chief advantages obtained by the application of this condenser to the low-pressure engine are:

1. The requisite amount of injection water is reduced in the proportion of 3 to 1.

2. The feed water of the boiler is obtained nearly boiling hot, which constitutes a saving in fuel of $\frac{210-110}{1,960}$ about 10 per cent.

3. The whole amount of heat generated under the boiler is given off by the engine in the form of water, at 210° Fahr., which, in most cases, may be advantageously employed for heating buildings, for washing, dyeing, and other purposes.

4. A large proportion of the power required for working the air-pump is saved.

The first regenerative condenser was attached to a 16-horse power high-pressure engine, at Saltley Works, near Birmingham, in September, 1849, where it has been found to answer, although it is not perfect in its proportions, and could not be kept constantly in operation, in consequence of a deficiency of injection water. The actual indicator diagram, shown in fig. 3, was taken from this engine; since then, several more have been erected, and the result above referred to obtained. The *dotted line* in fig. 3, shows the indicator diagram taken from the engine before the condenser was applied, and the *full line* shows the diagram of the engine working with the condenser, and exerting exactly the same power as in the former case. The *shaded portion* of the diagram shows the power gained or saved by the use of the condenser.

The author proposes to conclude this paper with a short historic sketch of the steam engine condenser, to illustrate the distinct features of this proposed system.

In Newcomen's engine, the condensation of the steam was effected by the alternate introduction of a jet of cold water into the steam cylinder itself. The cold water naturally cooled the walls of the cylinder, which in their turn condensed a large portion of the succeeding charge of steam before it had forced the piston upward.

James Watt, in seeking a remedy against this loss of heat, conceived the possibility of condensing the steam in a separate closed vessel; and in carrying his idea into effect, he not only realised his immediate object, but at the same time rendered the steam engine susceptible of that degree of perfection and general application of which it is now possessed. The injection condenser of Watt is the most effectual of its kind, and has maintained its exclusive dominion to the present day. It consists of a closed vessel, which communicates periodically with the steam cylinder. The injection water, together with the condensed steam and air, which is partly evolved from the injection water, and partly leaks in through the joints of the cylinder and exhaust pipe, are continually discharged from it by means of the air pump. Shortly after the introduction of Watt's condenser, a surface condenser was proposed by Hornblower, which consisted of a close annular vessel of thin metal plate, on the inner surfaces whereof the waste steam of the engine was condensed;

its latent heat being continually carried off by a stream of cold water which surrounded the vessel. A comparatively small air-pump was provided, which served to discharge the condensed water (to be again forced into the boiler) and some air which might leak in through the joints.

This condenser failed in practice, for want of sufficient extent of cooling surface. An effective surface condenser would possess considerable advantages over the injection condenser, especially in the case of marine engines. Allowing the condensed steam to be continually returned into the boiler, it prevents incrustation of the latter, and, moreover, dispenses with the necessity of blowing off. Its air-pump absorbs a much smaller proportion of the power of the engine, and its functions require less personal attention. Stimulated by these considerations several attempts were made to improve on Hornblower's invention, but since all these improvements partake very much of the same character, it is thought sufficient for the present purpose to mention only Hall's condenser, which has obtained the greatest amount of notoriety. It consists of two flat chests, or close chambers, which are connected together by means of a large number of brass tubes, through which the condensing steam circulates. These tubes are surrounded by cold water, which fills up the space between the flat chests. A small air-pump removes the condensed water and air from the lower chest. The great weight and costliness of this condenser, its liability to derangement, and the impossibility of removing the calcareous deposit of the water from the tubes, without taking the whole fabric to pieces, are found to be heavy practical objections.

In the year 1847, the author had occasion to apply a surface condenser, in a situation where economy of space and material were essential. In considering the most rational distribution of surfaces, he happened to find an arrangement which, with less than one-half the amount of material used in Hall's condenser, produced a very satisfactory result, and which paved the way to the more important improvement which forms the principal subject of this paper.

The surface condenser referred to (see figs. 4 and 5), consists of a number of copper-plates, of $\frac{3}{32}$ inch thickness, and about $4\frac{1}{2}$ inches broad, by 2 feet long, which are fixed together by two longitudinal flattened wires, of the same metal, between the adjacent plates; and the whole pile is screwed up tight together between the sides of a rectangular cast-iron vessel, which constitutes the body of the condenser. The ends of the plates project through the top and bottom of the condenser, and are planed flush with its exterior surfaces. The joints at top and bottom are secured by means of India-rubber rings, which are screwed down under small cast-iron frames, and yield to the difference of expansion between the two metals. The flattened wires are laid parallel, about 3 inches apart from each other. and form, with the plates, a large number of narrow passages, through which the cold condensing water flows in an upward direction, without entering the vacuous space of the condenser, into which the edges of the plates outside of the flattened wires project, forming the condensing surfaces.

The *rationale* of this condenser is as follows:

The transmission of heat in a surface condenser is threefold.

1. From the condensing steam to the internal metal surfaces.

2. From the internal surfaces, through the body of the metal, to its external surfaces.

3. From the external surfaces to the surrounding water by which it is carried off.

The first-named operation (condensation) would, it is presumed, proceed with undefined rapidity, if it were not retarded by the second and third, or by the presence of some permanent gases, which accumulate on the condensing surfaces, and prevent their immediate contact with the steam. The second (conduction) varies in direct proportion with the conducting power of the metal, and with its thickness; but the conducting power of copper is so great, that its thickness seems to exercise no appreciable influence on the amount of heat transmitted in a given time. This interesting fact is proved by Dr. Ure's experiment with two copper pans, of the same internal area, but very unequal thicknesses of bottom (being in proportion 1 to 12), which were both filled with water, and dipped into a hot solution of muriate of lime. It was found that the water in the thick pan evaporated the

quickest, which may be accounted for by its slightly increased external surface in contact with the heating solution; and this affords additional evidence that the limit of transmission does not lie within the metal, but rather between the metal surface and the liquid. That the absorption of the heat by the water is a slow process, may be inferred from the circumstance that water, although possessing a large capacity for heat, is a very bad conductor, and depends for its power to absorb heat on the slow circulation over the heating surface, caused by the inferior specific gravity of the heated particles of water. A strong artificial current along the heating surfaces greatly accelerates the process.

The surface condenser, above described, was arranged in accordance with these observations.

It contains:—Heat-absorbing surfaces (by the water), 18 square feet per horse-power; condensing surfaces 9 square feet per horse-power; computed mean thickness of metal through which the heat is transmitted, 1¼ inch; weight of copper, 60 lbs. per horse-power; space occupied by plates, 0·4 cubic feet per horse-power; about one-tenth part of the space occupied by the tubes in the tubular condenser.

The essential features of this condenser are, its comparative cheapness of construction, and the easy access which it affords to the water channels between the plates.

It also requires less condensing water than previous surface condensers, in consequence of the repeated and close contact in which each particle is brought with the heating surfaces, before it can reach the upper reservoir, or hot-well. The author considers that the surface condenser just described may be advantageously applied to marine engines, and being not subject to a patent, he hopes it will receive a sufficient trial.

Being required to save the waste steam of a low-pressure engine, in the form of slightly-heated water, by Mr. John Graham, of Manchester, the author, in the spring of 1847, conceived the idea of a regenerative condenser. Figs. 4 and 5 (p. 83) show his first arrangement, which may be termed a regenerative surface condenser. It consists of a revolving valve B, which admits the waste steam of the engine first to the atmosphere, at C, and, successively, into the separate compartments, D, E, F, G, where it is condensed at various densities. The cold water enters at H, and first passes between the plates within the last compartment, and by degrees through those within the first compartment, where the steam is of nearly atmospheric pressure, and consequently heats the water to nearly 212° Fahr., when it passes out at I.

The next step was an injection condenser, on the same principle as represented by fig. 6, page 83.

The revolving valve B, admits the waste steam of the engine, first to the atmosphere, at C, and then successively into the separate compartments, D, E, F, G, where it is condensed at various densities. The cold water is injected at H, and is passed down through the steam in each compartment in succession, by means of the displacing pistons KK, which work all on the same piston rod through each of the divisions between the compartments; and the heated water passes out at the bottom, at I.

L L are overflowing-distributing trays, for the purpose of bringing the water more rapidly and completely in contact with the steam. M is a small pump to extract the air that is mixed with the steam and water.

The regenerative condenser, in its present form, partakes of the nature of both the surface and injection condensers.

Attempts have been made, from time to time, to condense the steam of a high-pressure engine, without the aid of an air-pump, by blowing the steam into a small injection condenser, which is provided with a large exhaust valve.

It is clear that the steam of high pressure will, at first, partially blow through the condenser, and rid it of its air and condensing water, and that, by degrees, the jet of cold water will overpower the influx of steam, and consequently produce a vacuum. An arrangement of this description, although simple, is at least very imperfect, because it is a matter of considerable difficulty so to proportion the injection of cold water, that the first rush of steam is not forthwith condensed, but may

exert its expansive force in a cold vessel, and yet, an instant afterwards, effect a complete condensation of the remaining steam.

If too much water be used, the air and water will not be expelled, and consequently no vacuum be formed; if too little, no final condensation will take place.

The quantity of injection water must be very large, because the whole of the steam has to be condensed; and having to complete the condensation in the same vessel, it must leave it at a low temperature.

The principle of the regenerative condenser has been carried still further in the regenerative engine, which has been executed on a large scale by Messrs. Fox, Henderson, and Co., under the superintendence of the author. In it, the steam, after it has served to propel the working piston to the end of its stroke, is received into a series of consecutive chambers, from which it returns to the working cylinder an indefinite number of times.

Table of the Pressure of the Vapour of Water, from the Freezing to the Boiling point.

Temperature. Fahr.	Pressure. Ins. Mercury.	Temperature. Fahr.	Pressure. Ins. Mercury.
32	0·20	130	4·34
40	0·26	140	5·74
50	0·37	150	7·42
60	0·52	160	9·46
70	0·72	170	12·13
80	1·00	180	15·15
90	1·36	190	19·00
100	1·86	200	23·64
110	2·53	210	28·34
120	3·33	210	30·00

Mr. Slate inquired, what difference had been found in the consumption of fuel, in the engine at the Saltley Works, when the condenser was at work and when it was not working?

Mr. Siemens replied, that the experiment had been tried with one week's working with the condenser, and then one week without it; and the saving of fuel with the condenser was at the rate of 18 per cent. The apparatus with which the condenser worked was, however, too light, and had not been made for the purpose; also, that condenser was the first that had been made, and the proportions had been improved in the subsequent ones.

Mr. Wright confirmed Mr. Siemens' statement of the saving in fuel, and said there was a difference of about 8 cwt. in 1½ days. There had been irregularities in the working of the engine, and several stoppages had occurred from defects of the apparatus, which was too light.

Mr. Siemens said, there was a deficiency in the supply of condensing water, which sometimes interfered with the regular working of the condenser, as well as the defects arising from the gearing being too light for working it, and these had caused irregularities in the working of the engine; there was also a difficulty in regulating the engine with the present governor, as a condensing engine. The steam pressure was 30 lbs. per inch; but a smaller supply of condensing water would be sufficient, if a higher pressure of steam were employed.

The Chairman thought that, in a locomotive engine, the extraordinary rapidity with which the jets of steam were discharged, constituted a great impediment to the application of the condenser.

Mr. Siemens replied, that it would only be necessary for the condenser to work quick enough to condense one cylinder-full of steam before the next cylinder-full was discharged, and this he thought would easily be effected by widening the plates of the condenser to a proportionate size, and shortening the stroke of the condenser piston, so as to reduce its velocity as far as might be required. It would then return to the tender in pipes, between which air was caused to circulate by means of the rapid motion of the engine.

The Chairman observed, that there would be difficulty in keeping the water of the

tender cool enough for condensing, when there was very little left in the tender; and the water remaining at the end of the journey would be very hot and nearly boiling.

Mr. SIEMENS replied, that he expected the condensing water would be cooled down to about 100°, before it was returned to the tender, by the process of passing through the pipes of the refrigerator, from the rapid motion of the engine through the air; and the water was not required to be so cold as in the ordinary condenser, as only the last portion of the steam was condensed by injection.

Mr. COWPER observed, that only a small portion of the steam reached the injection water, the greatest portion being condensed previously, by the metallic plates, or discharged into the atmosphere; therefore the injection water might be about the same temperature as it usually came from the ordinary condenser. Also, the tender would not get empty so soon as usual, because a portion of the steam was condensed and returned back into the tender, instead of the whole being blown up the chimney: this gain might amount to one-third of the water employed.

Mr. SIEMENS showed, by a comparative indicator diagram, that with the application of the condenser to a locomotive engine, the steam might be cut off at about one-third of the stroke, instead of at two-thirds as usual, and thereby a saving of one-half the steam would be effected, with the same power.

The CHAIRMAN said, the subject of the application to locomotive engines was one of great importance, and he hoped it would be brought before the Institution in another paper. He proposed a vote of thanks to Mr. Siemens, for his paper, which was passed.

ROBBINS'S IMPROVEMENTS IN DISTILLING RESIN.

(From the "Scientific American," Dec. 13, 1851.)

On the 4th of November last, Mr. Louis S. Robbins, of New York, was granted four patents for as many different improvements —one was for distilling resin; the second, making paint oil; the third, tanners' oil; and the fourth, lubricating oil. We will endeavour to present the spirit of these four useful inventions in this article; and, first, we will describe the improved method of distilling resin.

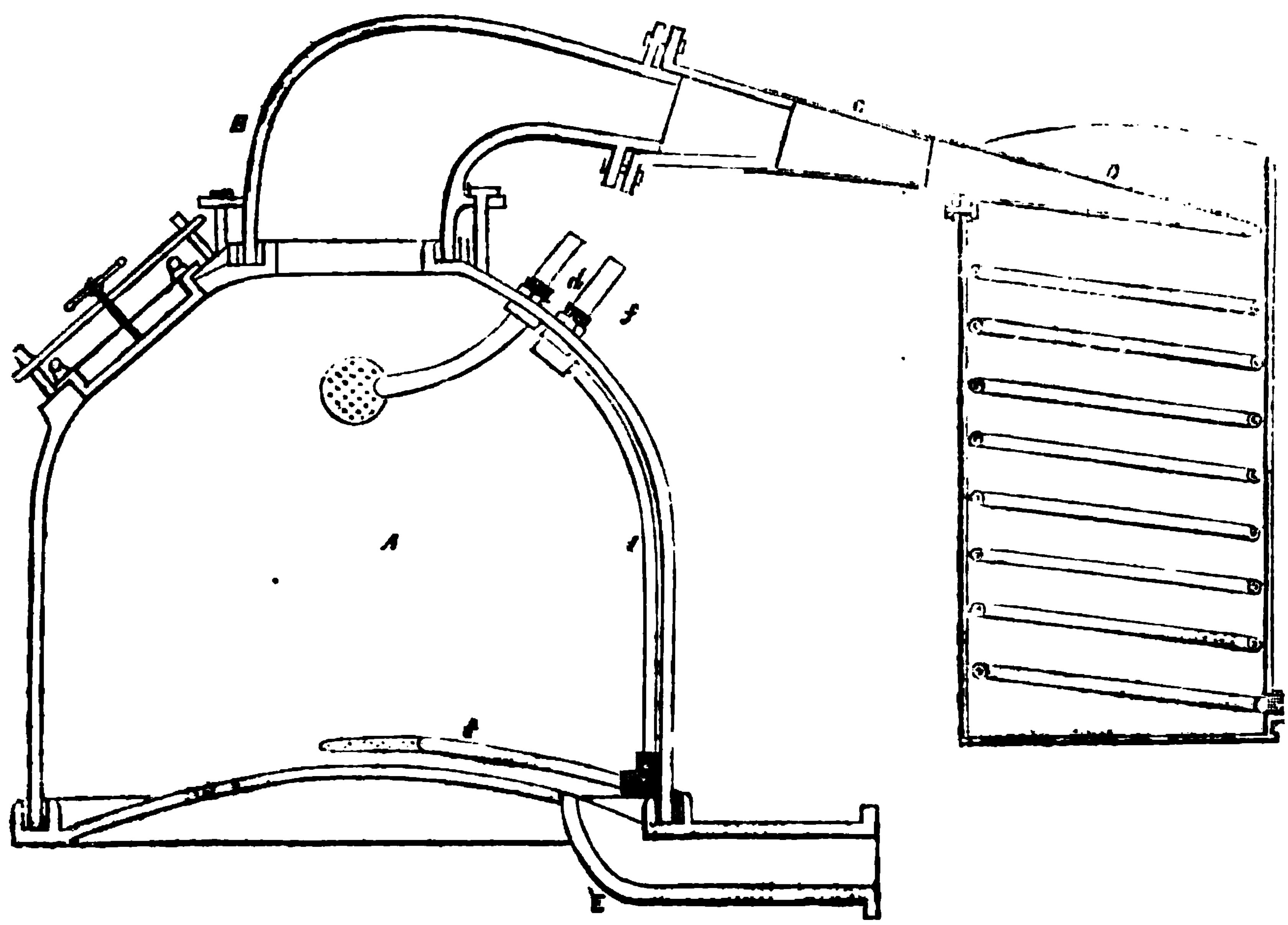
Fig. 1, is a vertical section of a distilling apparatus. A is the body of the still; B is a curved pipe connected with the top of the still; C is a moveable joint of pipe for connecting the curved still neck with the still worm D; *f* is a steam pipe which passes through a close joint in the side of the still, and thence is conducted down the inner side and along the bottom of the same, to near the centre of the bottom of the still, when it is curved into a circular form around it. The annular terminating portion of the said steam pipe that surrounds the centre of the bottom of the still is perforated with small holes, for the escape of the steam during a part of the time of the distilling process. A spiral, or any other form, may be given to the perforated terminating portion of the steam-pipe *f*. A thermometer must be so combined with the still as to indicate the temperature of what may be contained in the interior. Mr. Robbins makes use of Fahrenheit's thermometer. In the distilling of the resin, Mr. Robbins produces therefrom, in a separate and distinct form, acid, naphtha, and oil. A sufficient quantity of resin is put into the still to fill it up nearly two-thirds of its interior space, and then the resin is melted. At the time of making the fire under the still, a sufficient quantity of steam is blown into the still to moisten the resin; the pipe C is detached before the fire is made, because the resin is violently agitated during the early stages of raising its temperature, and until all the acid and water is expelled. During this agitation the resin is liable to overflow, and should it do so, the worm of the still would be greatly injured, and perhaps an explosion would be the result. The acid will begin to escape when the thermometer indicates the temperature of the resin to be 325°, at which point the fire must be regulated, and the temperature maintained about from 300° to 325°, until the acid shall cease to flow from the neck of the still. When it ceases to flow, the pipe C is connected to the still, and the joints of it luted, and the steam is then blown in through the pipe *f* into the bottom of the still. The temperature is kept at about the same point. As the steam rises through the melted matter, it takes up and carries with it, in the form of vapour, the naphtha contained in the resin; and these two mingled vapours pass off into the worm, where they are condensed and flow into a suitable vessel. This operation will continue until all the naphtha contained in the resin has been expelled; this is indicated by the character of the discharge, or when about 15 per cent. in bulk of the contents of the resin in the still has passed over.

As soon as the naphtha has ceased to flow from the worm of the still, the fire is increased until the contents of the still are

raised to 500°, the steam all the while being allowed to flow in, and is kept flowing in during the whole remainder of the process. The oil commences to fall off in vapour along with the steam when the heat is raised to 550°, when the mingled vapours pass into and are condensed in the still worm, from whence they are discharged into a suitable receiving vessel. The temperature of 550° must be kept up until the flow of oil nearly or quite ceases. The bulk of oil should be about 25 per cent. of the original quantity of resin.

The contents of the still are then raised

Fig. 1.



to 600°, when the flow of oil and moist vapour will recommence and continue until a second quantity of oil, equal to about 25 per cent. of the resin is discharged, when the flow of oil will nearly cease. The temperature of the still is then raised fifty degrees higher, when the flow of moisture and oil will again recommence and continue under the same heat until a third quantity of oil is discharged, equal to about 12½ per cent. of the bulk of the resin originally placed in the still, after which the fire is to be extinguished. The residue left in the still is of a nature like pitch; this is drawn off through the pipe E. The steam-pipe *g*, which passes through a close joint in the side of the still, and terminates in a perforated coil *h* in the upper part of the still, is for allowing steam to be injected through it upon the oil when it is in a state of vapour, and this produces a purifying effect upon the oil.

Paint Oil.—The same still, fig. 1, is used for making this oil, but other apparatus (figs. 2 and 3) are also employed. Fig. 2 is a vertical section of a bleaching and purifying kettle, and fig. 3 is a top view of it; *k* is the bleaching and purifying kettle; *l* is a steam-pipe, combined therewith in such a manner as to enable the temperature of the oil to be raised when placed in the said kettle, and *m* is a steam-pipe terminating in a perforated head *n*, through which steam is injected into the oil.

A quantity of oil made at 650°, as described, is placed in the still, fig. 1, and then the man-hole of the still is closed and luted. The contents of the still are then raised to 650°, and kept at that point until the process is completed. At this heat the oil passes off as vapour, when steam is injected into the still through the pipe *g*. The oil is condensed in the worm D, and is conducted off into a suitable vessel. The oil thus produced is again distilled in the same way, and when re-distilled, it is placed in the kettle *k*, in which its temperature is raised to about 225° by steam, through the

pipe *l*, and then at that point steam is let in through pipe *m*, until the oil is freed, and until the acid and colouring matter is expelled, when it will be quite clear and fit to be boiled for paint, like linseed oil.

Tanners' Oil.—A quantity of the oil produced, as described, is placed in the still, fig. 1, also some slacked lime—about 5 per cent of the quantity of oil. The man-hole of the still is then closed and luted, and the contents of the still raised to 600°, and maintained at this point until the whole

Fig. 2.

Fig. 3.

process is completed. The steam is introduced through pipe *f* when the temperature has reached 300°, and through pipe *g*, when it has attained to double that heat. The oil passes in vapour into the worm D, and from thence flows into a receiving vessel. The oil produced by this process is again distilled in the same manner as that described, but instead of slacked lime, the same quantity of caustic lime is employed. The oil produced by the re-distillation is placed in the purifying vessel *k*, figs. 2 and 3, and its temperature raised, as described in the process of producing painters' oil. This oil is clear and pure, and entirely free from acid, making an excellent currier's oil.

Lubricating Oil.—A quantity of oil produced as described at 550°, is placed in the still (fig. 1), and a quantity of slacked lime, equal to 5 per cent. of the oil, is placed along with it. The man-hole is luted, and the temperature is raised and maintained at about 550°, until the process is completed. The steam is let on as described in making the tanner's oil. The oil passes off in vapour into the condensing worm D, from which place it is conveyed into a suitable receiving vessel. This oil is re-distilled and treated exactly as that for making the currier's oil, after which it is run into the purifying kettle, and treated as before described. It is then pure and limpid.

The improvements are valuable ones, and of that kind of products recognised in the old and established charter of patent rights, under the head of "New and Useful Manufactures." In our country there are fewer patents secured for chemical than mechanical improvements, and much less in number are they than we find in the lists of French and English patents. We hope to see more of them, for it is our humble opinion that, much as we are indebted to mechanical inventions, we are none the less to chemical discovery. The improvements of Mr. Robbins are very valuable.

THE OPERATIVE ENGINEERS' STRIKE.

Sir,—The article in your last Number, headed "Masters and Men," induces me to offer a few remarks on this question, which is just now attracting so much attention. The question would be an important one, even if it had reference solely to the difference between the engineers and their employers; but, as every one sees, it is in reality a general question, involving the whole problem of the relative claims of capitalists and labourers. In the words of the *Spectator* (Jan. 24), "the public has a very deep interest in the matter; for the re-

gulation of industry in reference to production lies at the bottom of the dispute." And the proceedings of the engineers are rightly described as "a matter which profoundly interests society, as an essay towards the practical empirical working out of a difficult problem,—a matter to which the attention of the public has been repeatedly invited;" and in which, therefore, every thinking person will cordially agree with the writer of the article just cited in "deprecating the systematic misapprehension which obscures the real subject, and is perpetually interposed between the facts and the public view."

It is, indeed, a "difficult problem," when treated in its widest form, and traced to its ultimate consequences; but some parts of the question are, I think, clear enough, if we sweep away a few verbal cobwebs to begin with.

Each party talks about their "*rights.*" For instance, at the late meeting in St. Martin's-hall, the first resolution was—"That the employers of operative engineers, having enunciated their right to do what they like with their own, and denied the operative the right to do what he likes in employing his own wages, and devoting his spare time as he will; and, having demanded an unconditional submission, this meeting declares that such submission would be at once both impolitic and disgraceful." And the mover of this resolution, Mr. Usher, in his speech, after remarking, very truly, "that this was a struggle in which the rights of all the working classes in this great country were involved," proceeded thus:—"They asked their employers to put an end to systematic over-time and to piece-work; but the employers said it would be impossible to comply with those demands, because they could not then execute the pressing orders that were sometimes given to them. That, however, was not, he believed, the true cause of the course they were pursuing. They refused to abolish over-time *because they desired to amass wealth quicker than the laws of fair trading would permit.* They spoke of the competition to which they were subject; but they had themselves created that competition by their eagerness to amass large fortunes. *It was not fair that the labourers should suffer in consequence of that breathless struggle for wealth among the masters. The labourers had a* RIGHT *to enjoy an* EQUITABLE *profit from the works which they performed:* and he contended that nothing could be more unjustifiable than the position then occupied by their employers." (The italics are my own.)

Now as disputes may go on for ever, if we do not first settle the exact meaning of the words we use, let us just ask what is meant by the term "Right," or "Rights," in the speech now quoted. If this question were put to every one of the engineers at that meeting, the reply would probably, in nine cases out of ten, be—"Why, what I mean is this: *I don't think it fair* that masters should *get so much*, whilst I get *so little.*" Behold a host of more indefinite and ambiguous expressions! And so we may go on ringing the changes on these words "right," "fair," "just," "equitable," and so on. Now I ask by what abstract principle am I to decide this question of right and wrong in the settlement of the terms of a contract? On what axiom of natural justice can I base the foundation of the inquiry—"What proportion of the profits is to go to the employer, and what proportion to the labourer?" There are certain rights which every one understands. One man has no *right* to kill another without any provocation, for instance. But there are other so-called "rights" which are vague and indefinite to the very last degree: and of this nature are the relative proportions in which the profits of industry *ought* to be divided. John employs William to make a steam engine, which he sells with a thousand pounds' profit: by what moral arithmetic am I to find out whether John should receive 900*l.*, and William only 100*l.*, or any other proportion?

Mr. Usher charges the employers with "desiring to amass wealth quicker than the *laws of fair trading* would permit." Now I want to know what "the laws of *fair trading*" are? Of course, we put out of view such laws as those of common honesty—in not using false weights, or telling lies, for example. Suppose a grocer gets a profit of one shilling on a pound of tea, and the old woman who buys it says, "By the laws of fair trading your profit ought only to be sixpence;" I want to know who is "right"—grocer or old woman? Take another case:—A writing-master gives lessons at

half-a-crown each; one of his pupils says, "You are a rascal, and violate the commonest rights of man: I refuse to pay you more than eighteen-pence for a lesson, and I insist on your compliance." It is really very strange that so much obscurity should ever accompany so simple a question. Every contract involves as much difficulty as these two examples we have given, and no more. Each party has a *right* to make their own terms. In the present case, it appears as plain as possible that the employers have a "*right*" to use their capital as they please, and the men to use their labour as they please.

But as this goes but a small way towards the solution of the general problem before us, with your permission I will continue my observations in a future Number.

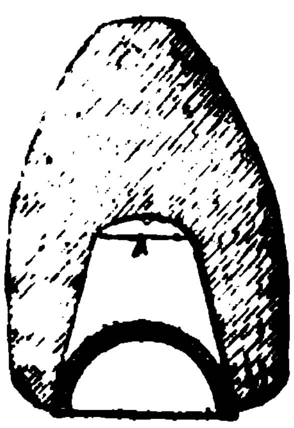
I am, Sir, yours, &c.,
A. H.

Feb. 2, 1852.

IMPROVED BULLET.

Sir,—In the present unsettled state of the Continent, and rumoured invasion, the chief desire of all classes seems to be to obtain a good, cheap, and serviceable fire-arm. I therefore take the liberty of an old subscriber, to lay before the public, through your most useful Journal, a suggestion by which a *smooth barrel* may be made nearly, if not quite, equal to the "Minié Rifle." This effect may be obtained by the use of a peculiar form of shot or ball.

Fig. 1. Fig. 2.



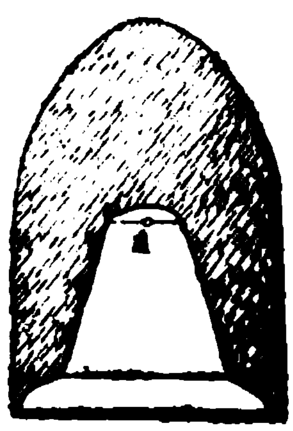


Fig. 1 is a section showing that now being made in the Woolwich Arsenal, and called the "Minié Ball," having an inner cup of iron in the cavity, which iron cup is driven further into the cavity of the shot the instant the powder is fired, forcing the lead to fit the barrel perfectly. Now, the ball (fig. 2) I would suggest, does not require the inner cup of iron, and is not *cast* but *pressed* in a die, which would give it *density*, *cheapness*, and *perfect shape*, the force of the powder will be exerted nearer the centre of gravity, AA, figs. 1 and 2, and will ensure greater accuracy of flight; the wedge-shaped edge would slightly open on being dropped on the powder, and therefore, as in the "Minié Rifle," requires no ramrod.

I will not occupy your valuable space by farther remark, for it will be obvious to any marksman that a ball so constructed will go further, and with greater accuracy of aim, from a smooth bore than any now in use.

I am, Sir, yours, &c.,
WILLIAM MURRAY.

February 1, 1852.

HJORTH'S ELECTRO-MAGNETIC ENGINE.

Sir,—Having read Professor Page's lecture on electro-magnetic engines, which appeared in your Magazine of the 10th instant, I beg leave to make a few remarks on that part of it which relates to Mr. S. Hjorth's engine, which is there spoken of as one of "the most ingenious electro-magnetic engines ever invented in Europe." This, no doubt, may be correct so far as arrangement of parts is concerned; but there is something more required in constructing a machine than mere ingenuity—there must be utility combined with ingenuity, to render it worthy of public favour.

Now, as this engine has frequently appeared before the public as a most ingenious invention, and as I have never heard anything stated concerning the results of experiments that might have been made with it, perhaps it may be interesting to some of your readers to hear something of its private character and its final end. One peculiarity of Hjorth's engine is that it requires a most enormous quantity of electricity to produce a very small amount of power. Another is, that the larger the engine the less the power, even with a great increase of battery surface. The first model that Mr. Hjorth exhibited in England, was a small horizontal one, consisting of two moving and two stationary magnets; this I have seen run at the rate of 90 to 100 revolutions per minute, with a battery consisting of

four Maynooth cells, with a surface of 72 square inches of zinc in each cell. The next model was an oscillating cylinder engine (which is represented in the engraving prefixed to your report of Professor Page's Lecture). This, although the magnets were not more than twice the size of the preceding one, required more than four times the amount of battery power to produce the same effect. The next engine that was built, was to have been of one horse power, according to calculation, but it fell woefully short of the expectations of the parties concerned, for with all the battery power that was ever applied, the available power of the engine was so very small that it was never attempted to apply it to propel any kind of machinery whatever. The last and grand trial was made at the Horseley Iron-works, Staffordshire, where an engine was built which was calculated to be of four horse power; but although it was of first-rate workmanship, and every effort made to give it a fair chance of success, it never made a single stroke, or showed the slightest signs of movement; although I have seen pieces of iron more than a quarter of an inch in diameter instantaneously welded together by the great intensity of the electric current from the battery, which was constructed on the Maynooth principle, and had eighty square feet of zinc surface in action. The governor spoken of as regulating the quantity of electricity to the engine was never made, consequently was never applied.

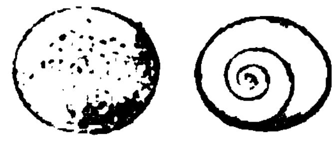
Such are a few facts connected with this invention, of which I was an eye-witness; and as they may serve to guard the public against indulging in fallacious expectations of the motive power derivable from electro magnetism, I send these for insertion in your impartial pages; and remain

Yours, Sir, &c.,
ELECTRO-MAGNET.

Birmingham, January 26, 1852.

EYE-STONES.

Sir,—A short time ago, a gentleman put into my hands a couple of small objects of a shelly nature, which, he said, were found on sea-weeds on the shores of the North Sea, and were called *eye-stones*, from the fact of their being used by sailors to remove any fragments which might have accidentally got into their eyes. The eye-stone was put under the lid, and allowed to remain in contact with the eye until, by the irritation which it caused, the fragments were removed. The eye-stones in my possession are of the size and appearance represented in the subjoined engravings, the upper surface *a* being rough and slightly convex, the under surface *b* perfectly smooth and solid,—marked, indeed, with a spiral line, but having no corresponding depression.



a *b*

The strange use to which these objects are applied is not, however, the only remarkable thing related of them. It is also stated that they are inhabited by living animals, which, on being excited by immersion in vinegar, put out tentacula, and move about. The experiment has been tried with the eye-stones in question, and they certainly do move about in a vessel of vinegar, either making for the lowest point, and remaining there in contact with each other, if the vessel be slightly concave, as a saucer, or moving towards the sides, or towards each other, if the vessel be perfectly flat. Before beginning to move, a few bubbles of gas are disengaged, and while in motion, a trail of minute bubbles is left behind each stone. Placed in salt water, they do not move at all, nor is any gas disengaged.

Setting aside the notion of these solid substances being inhabited, which is simply absurd, the cause of the motion seems easy of explanation. The vinegar, acting on the carbonate of lime of the shell, disengages bubbles of carbonic acid from the flat, smooth, and comparatively soft under surface; the upper, or convex surface, being formed of a harder, nacreous material. These bubbles accumulating under the shell, gradually raise and support it, and being thus free to move with scarcely any friction, one shell is attracted by the other, just as two corks attract each other when placed on water, and as the scattered masses of a wrecked ship collect together when the sea becomes calm.

The appearance of tentacula must be ascribed to the imagination of the observer, which converted the shadows of the bubbles of gas into those organs.

In support of this explanation, it occurred to me that artificial eye-stones might be formed, capable of moving about in vinegar like the real ones. My first attempts were with marble, some small pieces of which were formed convex above and flat below, the convex part being coated with wax. On placing these in vinegar, the marble which was loose and porous in texture, simply fell to pieces. A better result was obtained with a more compact variety of carbonate of lime, Iceland spar. A framework of paper was first formed and coated with sealing-wax in every part. The lower or flat surface was then held near the flame of a candle, and the wax thus softened, was pressed down into some rasped fragments of Iceland spar. The substitutes for eye-stones thus formed moved about in vinegar tolerably well for a time, and then stopped. On again softening the wax, and taking up more powder, they again became lively, thus confirming the idea as to the origin of the motion.

To conclude;—I am informed that these eye-stones are the opercula of some variety of *turbo;* the horny operculum or lid, which closes the mouth of the common periwinkle, being in this case replaced by a stony or shelly one.

I remain, Sir, yours, &c.,

CHARLES TOMLINSON.

Bedford-place, Ampthill-square, Feb. 2, 1852.

THE "AMAZON."—EXTINGUISHING FIRE.

Sir,—A correspondent in your last Number has suggested the adoption of a cock (a valve would be better) in the steam pipes of sea-going steam ships.

That the effect would be certain so far as stopping the engines is concerned, there can be no doubt; but in addition to this, I would recommend a ready and certain means of extinguishing fire before it could obtain a mastery over the combustible material of the ship.

I would suggest that all sea-going steam vessels should be furnished with a steam-pipe of 3 or 4 inches diameter, leading from the steam-chamber of the boiler, and with branch service pipes directed to the various compartments of the vessel and fitted with valves, or stop-cocks, which can be opened from the deck.

On the breaking out of fire in any part of the ship, below deck, its immediate suppression would be certain and instantaneous, if steam was let into the burning compartments and I believe that experiments were made on the Thames a few years ago, proving the efficacy of steam as a perfect extinguisher of fire.

Steam ships, fitted with a judicious arrangement of these extinguishing appliances, would be, even *much safer* than sailing vessels, which have not such means of safety at command.

I am, Sir, yours respectfully,

JOS. STENSON.

Northampton, January 28.

AMERICAN "WORLD'S FAIR."

We learn, from the last Number of the *Scientific American* which has come to our hands, that, though the pigmy scheme of Riddle and Co. (see *ante*, page 96), is generally repudiated by their countrymen, there is a project on foot for an American Crystal Palace, which shall far transcend our London model in all respects. "We have seen," says our contemporary, "the model of a Crystal Palace, by M. Bogardus, of this city (New York), the well-known American inventor, whose fame is world-wide, and whose iron buildings are unrivalled for strength, simplicity, and beauty. The design, we hope, will not be first applied to the dwarf Museum of Riddle, but to a World's Fair, to be held in our country not many years hence. The design is superior in all its details to the London Crystal Palace. It can be built ten miles long, and all the harmony of its parts preserved. The roof is entirely new in principle and plan, and it will never leak—no goods will be spoiled by passing showers, and to show how much prudent utility and calculating forethought there is in the plan, after it has served for a Crystal Palace, it can be taken down and made into a number of iron buildings without alteration, one of which may be put up in every separate State of the Union. It is so planned that none of the braces and binders, which so disfigured the interior of Paxton's great work, will be required; it will be simple, yet beautiful and grand—a design original and unique, one worthy of our country—eminently American, yet cosmopolite enough to cover the industrial products of all nations, and to command the admiration of the inhabitants of all lands. The American who would import a Crystal Palace should be *transported*."

THE OPERATIVE PRINTERS' ASSOCIATION.

Sir,—You finish your article on "Masters and Men," in your Number of January 31, with what looks like a very telling argument against Working Men's Associations; namely, the fact (as you assume it to be), that the Working Printers' Association had undertaken to produce more copies of Mr. Vansittart Neale's pamphlet by Monday afternoon, but which they did not produce till Wednesday afternoon, and that this delay arose from there being no one person in the Association who was responsible to Mr. Neale, or to whom the Associates were responsible.

As every one of these three assumed facts is a pure fiction (though I am sure you believed them to be true), and as your assertions may do great harm to a most deserving body of working-men, who have been for a long time struggling nobly against great difficulties, I trust you will allow me to state the real facts of the case, and explain how your mistake arose.

You were, I assume, from your article, at the Engineers' Meeting on Monday afternoon, the 26th, and perhaps saw Mr. Neale bring fifty copies of his pamphlet on to the platform; these copies had been struck off by themselves, and bound up without the three last sheets having been hot-pressed, in order to get a few ready for the influential men who attended the Meeting. Mr. Newton, in ignorance of this, and without any previous communication with Mr. Neale, stated directly after his speech, that more of the pamphlets could be had that afternoon. Mr. Neale was at the other end of the platform, and could not correct Mr. Newton's misstatement at the time, and did not think it of sufficient importance to do so afterwards. The Printers' Association contracted to have fifty copies ready on Monday—and had them; to have the rest ready on Wednesday, and had them too.

Of the second and third fictions which you assume to be facts, they evidently suggested themselves to your mind at the time you were writing; and as you were "by no means prejudiced in behalf of employers and against operatives," it was perfectly just, of course, in you to put down, without any inquiry, a fancy as a fact, when that fact would only prove, on the one hand, that the operatives were ignorant and absurd, and incapable of doing work properly,—on the other, that masters, in their present relations with their men, were absolutely indispensable. Just as you had, in a former page, with the same impartiality, given vent to a sneer at the men's statements about overtime, which I assert can be proved to be true, calling it "sickly cant," while you can find no expression of condemnation for the abominable hypocrisy of the employers, who turned their labourers out to starve under the pretence that they were protecting them from the aggressions of the operatives.

I beg to inform you that all Working Men's Associations have a manager, who is responsible to the customers, and that all the associates are responsible to the manager, according to the laws agreed on between them. The least inquiry into the subject would have shown you this.

I am, Sir, yours, &c.,
FRED. J. FURNIVALL.

11, New-square, Lincoln's-inn,
February 5, 1852.

[Our correspondent charges us with having invented three fictions, only one of which, however, he has condescended to specify. If he will take the trouble of reading his letter again, he will see that the first of the three "assumed facts" was not a fiction of ours, but, on the showing of our correspondent, appears to have been invented by Mr. Newton, whose announcement, from the position he holds, we took to be authoritative.]

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING FEBRUARY 4, 1852.

JAMES TIMMINS CHANCE, of Birmingham. *For improvements in the manufacture of glass.* (Being a communication.) Patent dated July 28, 1851.

The scope of the present improvements will be readily gathered from the claims, which are—

1. The employment, in connection with the same flattening kiln, of more than one flattening stone or bed, the same not being connected together by a common supporting base or frame, and in such manner that two flattening beds or stones may be interchanged without one having to pass directly over or under the other.

2. The combination of rollers or trucks with the prongs or implements used for lifting and transferring plates of glass.

RICHARD LLOYD, of Paris. *For improvements in steam-engines and in heating steam.* Patent dated July 28, 1851.

The object proposed by the present patentee is to provide suitable means for enabling steam-engines to be worked by surcharged or superheated steam. For this purpose he combines with boilers of any ordinary construction, a surcharger or chamber communicating with the steam boiler, and heated by the same furnace, in

which the steam is raised to a high degree of temperature. The surcharging chamber is provided with suitable valves for admitting steam from the boiler, and has also a safety-valve and a thermometer for indicating the temperature of the surcharged steam. The patentee proposes to obviate the disadvantages attendant on the use of superheated steam with pistons packed in the ordinary manner, by the employment of a packing composed of asbestos cloth, or cloth made from asbestos combined with steel wire, or springs and tallow.

Claim.—The combined means for heating and employing steam, as described.

JOHN WORKMAN, of Stamford-hill. *For improvements in the manufacture of bricks, tiles, and other articles made of like materials.* Patent dated July 31, 1851.

This invention consists of a method of treating bricks and tiles for the purpose of rendering them impervious to wet by saturating them with certain oils.

The patentee employs for this purpose an arrangement of apparatus, in which the bricks to be operated on are first subjected to the action of heated air, at a temperature of about 500° Fahr., in a chamber suitably contrived for that purpose, and are then immersed, while in a heated state, in whale or seal oil, to every gallon of which there is added one-fourth of an ounce of acetate of lead. The bricks or tiles, on being withdrawn from the oil bath, are again subjected to the action of hot air, and are then delivered from the apparatus to be stacked, in which condition they are allowed to remain for about a fortnight, to give time for the oil to oxidize. This course of treatment is adopted when the bricks are to be immersed in or remain in contact with water; but when employed for facing buildings, where they are exposed only to the influence of a damp atmosphere and occasional rain, linseed oil is used instead of whale or seal oil, and it is not necessary to heat them before immersion to so high a temperature as that above indicated; in other respects the process is the same as just described.

CHARLES BARLOW, of Chancery-lane. *For improvements in saws.* (A communication.) Patent dated July 31, 1851.

These improvements consist in manufacturing saws with fleam and chisel teeth combined, by which means the saws cut more easily, and are enabled to clear themselves more readily than those having one only of the above descriptions of teeth.

For saws which are intended to cut in one direction only, the fleam and chisel teeth are placed alternately, the former being set in opposite directions, as usual, while the latter have no "set," and act on the wood in the manner of planes, removing the stuff in shavings, instead of making sawdust; but when the saws are used for cutting in both directions, the teeth are arranged by twos (the cutting edges of each pair being turned in opposite directions), except at the ends, where there are a greater number of fleam teeth; both of these arrangements may, however, be varied.

Claim.—The combination in the same saw of fleam teeth and chisel teeth, as described.

VICTOR LEMOIGN, of Cette. *For certain improvements in rotary and other steam engines.* Patent dated July 31, 1851.

The rotary engine, which forms the subject of the present patent, consists of an external cylinder of irregular internal contour, within which revolves a drum fixed to the main shaft of the engine, and provided with four blades or pistons, which are successively protruded from the drum to be acted on by the steam as it enters the cylinder. The pistons are connected in pairs by links, so that while one is protruded to its fullest extent, the other one opposite to it will be drawn within the drum. The position of the drum is eccentric to the axis of the main cylinder, the interior of which it touches at two points of its circumference, and these points being packed, to prevent steam passing, act as stops or abutments. The pistons are actuated by eccentrics or cams, external to the cylinder, for the purpose of causing them to be protruded from the drum at the proper moment to be acted on by the entering steam, and again drawn within it when the steam has exerted its impelling force.

Claims.—1. The general arrangement and construction of the rotary engine described.

2. The peculiar form of eccentrics or cams for working the blades.

3. The system or mode of actuating the blades.

4. The application and use of external eccentrics or cams.

PETER ROBERT DRUMMOND, of Perth. *For improvements in churns.* Patent dated July 31, 1851.

The improved churn described by Mr. Drummond consists of an oval-shaped vessel of wood, divided by a perforated sliding partition into two compartments. Each compartment is provided with a dasher, the spindle of which is made hollow, and has valves for the purpose of introducing air into the churn during the time of its working. The two dasher spindles are connected by a cord passed over a pulley, to which an alternating movement is communicated from a fly-wheel, to which is attached a handle

for setting the whole in motion. The dashers are thus caused to move alternately up and down, introducing air at every stroke; and the process of churning is, by these combined arrangements, much facilitated. The partition which divides the churn into compartments slides up and down in grooves, to enable it to be readily removed for the purpose of cleaning.

Claim.—The combination of the parts described into a churn.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Joseph Maximilian Ritter von Winiwarter, of Surrey-street, Strand, Middlesex, Doctor of Law, for certain improvements in the locks of fire-arms and cannon, and in gun-matches, or in the mode of igniting gun powder used in guns, and in machinery for manufacturing the same. January 20: six months.

William Smith, of Kettering, Northampton, agricultural implement maker, for improvements in apparatus for cutting or breaking lump sugar, and other vegetable substances. January 29; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the manufacture of pigments or paints. (Being a communication.) January 29; six months.

Edward Highton, of Clarence-villa, Regent's-park, Middlesex, civil engineer, for improvements in electric telegraphs. January 29; six months.

William Longmaid, of Beaumont-square, Middlesex, gentleman, for improvements in obtaining gold. January 30; six months.

Owen Williams, of Stratford, Essex, engineer, for improvements in preparing compositions to be used in railway and other structures, in substitution of iron, wood, and stone. (Being a communication.) January 31; six months.

Charles Cowper, of Southampton-buildings, Chancery-lane, Middlesex, for improvements in multiplying motion applicable to steam engines, saw-mills, and other machinery in which an increase of velocity is required. (Being a communication.) January 31; six months.

Martyn John Roberts, of Woodbank, Gerrard's-cross, Bucks, Esq., for improvements in agricultural instruments. January 31; six months.

Alexander Hediard, of 25, Rue Tait Bout, Paris, France, gentleman, for improvements in propelling and navigating ships, boats, and vessels by steam and other motive power. January 31; six months.

Joseph Haythorne Reed, late of the 17th Lancers, Harrow-road, Middlesex, gentleman, for improvements in propelling vessels. January 31; six months.

Richard Archibald Brooman, of the firm of J. C. Robertson and Company, of Fleet-street, London, patent agents, for improvements in the purification and decoloration of oils, and in the apparatus employed therein. (Being a communication.) January 31; six months.

William Squire, of High-holborn, late of George-street, Euston-square, both in Middlesex, pianoforte-maker, for improvements in the construction of pianofortes. January 31; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in machinery for weaving coach-lace, Brussels tapestry, and velvet carpeting, and other piled fabrics. (Being a communication.) January 31; six months.

Frederick Philip Thompson, of Waterworks-chambers, Orange-street, Trafalgar-square, engineer and surveyor, for improvements in filtering and preserving water. February 2; six months.

George Spencer, of Lacey-terrace, Islington, engineer, for improvements in the springs of railway carriages, trucks, and waggons. February 2; six months.

Samuel Cunliffe Lister and James Ambler, both of Manningham, in the parish of Bradford, York, manufacturers, for improvements in preparing and combing wool and other fibrous materials. February 2; six months.

Emanuel Charles Theodore Croutelle, manufacturer, of Rheims, for certain improvements in machinery or apparatus for preparing woollen threads and other filaments. February 3; six months.

Robert Hesketh, of Wimpole-street, St. Marylebone, Middlesex, for improvements in apparatus for reflecting light into rooms and other parts of buildings and places. February 3; six months.

Peter Claussen, of Gresham-street, London, gentleman, for improvements in the manufacture of saline and metallic compounds. February 3; six months.

George Torr, of the Chemical-works, Frimley's-lane, Rotherhithe, animal charcoal-burner, for improvements in reburning animal charcoal. February 3; six months.

LIST OF SCOTCH PATENTS FROM 22ND OF DECEMBER, 1851, TO THE 22ND OF JANUARY, 1852.

James Macnee, of Glasgow, Lanark, North Britain, merchant, for improvements in the manufacture or production of ornamental fabrics. December 26; six months.

Jean Antoine Farina, Paris, proprietor, for a process for manufacturing paper from a certain material. December 26; six months.

Francis Hastings Greenstreet, of Albany-street, Mornington-crescent, Middlesex, for improvements in coating and ornamenting zinc. December 29; six months.

Frederic Rosenborg, Esq., of the Albany, Middlesex, for improvements in the manufacture of casks, barrels, and other like articles, and the machinery employed therein. January 2; six months.

James Aikman, of Paisley, calenderer, for improvements in the treatment or finishing of textile fabrics and materials. January 6; six months.

James Gathercole, of Eltham, envelope manufacturer, for improvements in the manufacture and ornamenting of envelopes, parts of which improvements are applicable to other descriptions of stationery, and in the machinery, apparatus, and means to be used therein. January 8; six months

Edwin Rose, of Manchester, engineer, for certain improvements in boilers for generating steam. January 9; four months.

Thomas Richardson, of Newcastle-upon-Tyne, for improvements in the manufacture and preparation of magnesia, and some of its salts. January 12; six months.

James Warren, of Montague-terrace, Mile-end-road, gentleman, for improvements applicable to railways and railway carriages, and improvements in paving. January 13; six months.

Alexander Parkes, of Birmingham, for improvements in separating silver from other metals. January 13; six months.

Alexander Hediard, of 26, Rue Taitbout, Paris, for improvements in propelling and navigating ships, boats, and vessels, by steam, and other motive power. January 16; six months.

LIST OF IRISH PATENTS FROM 21ST OF DECEMBER, 1851, TO THE 19TH OF JANUARY, 1852.

Alphonse René Le Mire de Normandy, of Judd-street, Middlesex, gentleman, and Richard Fell, of

the City-road, in the same county, engineer, for improved methods of obtaining fresh water from salt water, and of concentrating sulphuric acid. December 22.

Charles Watt, of Kennington, Surrey, chemist, for improvements in the decomposition of saline and other substances, and separating their component parts, or some of them, from each other; also, in the forming certain compounds or combinations of substances, and also in the separating of metals from each other, and in freeing them from impurities. December 22.

Matthew Gibson, of Wellington-terrace, Newcastle-upon-Tyne, for improvements in machinery for pulverising and preparing land. January 3.

Antoine Dominique Sisco, of Slough, for improvements in the manufacture of chairs, and in combining iron with other metal applicable to such, and other manufacture. January 3.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Jan. 29	3093	T. Fotherby and Son	Leeds	Setting up brush.
"	3094	J. Shaw	Southover Laves	Dried fruit dressing machine.
"	3095	H. A. Hall	Spalding	Pump and fire engine.
30	3096	T. H. Ryland	Birmingham	Joint for parasol handle.
"	3097	H. Field and Son	Glasgow	Domestic gas apparatus.
"	3098	A. Hewlett	Burlington Arcade	Caliendrum (wig.)
31	3099	T. Woolley	Nottingham	Parts of the action of a pianoforte.
Feb. 2	3100	J. Bedington	Birmingham	Hat and coat guard.
"	3101	J. Jacquier	Wood-street, Spitalfields	Jacquard machine.
"	3102	Wolf and Baker	Sambrook-court	Revolving fusee-box.
3	3103	W. Jefford and S. Turner	New Radford, Nottingham	Improvements in twist lace brass bobbins.
"	3104	S. F. Cottam	Manchester	Bearings for spindles of spinning, doubling, and winding machines.
"	3105	T. Smith and Sons	Birmingham	Wick-holder and elevator for Argand lamps.
4	3106	J. H. Fiedler	Addle-street	Travellers' expanding bag.
"	3107	M. Hyams and Co.	Long-lane	Exhibition cigar.
"	3108	J. Warner and Sons	Jewin-crescent	High-pressure valve.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

Jan. 22	354	George Metcalfe	Algarkirk, near Spalding	Steam wheel.
23	353	Rose Jacobs	Cockspur-street	Lamp or candle shade.
24	356	G. F. Phillips	Nassau-street	Diasometer, for measuring heights, lengths, and widths of objects, &c.
28	357	F. H. Elwin	Lincoln's-inn	Lath sails.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburg.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1488.] SATURDAY, FEBRUARY 14, 1852. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

COMBINED STEEPLE ENGINE OF THE UNITED STATES MINT.

COMBINED STEEPLE ENGINE OF THE UNITED STATES MINT. DESIGNED BY FRANKLIN PEALE, CHIEF COINER, AND CONSTRUCTED BY I. P. MORRIS AND CO., OF PHILADELPHIA.

The general design of this engine conforms to the Gothic or pointed style, and its construction is what is commonly known as the steeple engine, working by simple high-pressure; there are, however, peculiarities, and as far as is known to us, novelties in construction, which it is thought are entitled to attention.

It will be observed on inspection of the engravings, that it is a combined or double engine, with the cranks at right angles; that it has no fly-wheel, properly so called, but a pulley or drum, from which the power is carried off by a broad belt (2 feet in width). The drum is cast hollow, with chambers in the periphery, into which lead has been run, to counterpoise exactly, the pistons, triangles, pitmen, &c., so that the engine is in perfect equilibrium in every position, and performs its revolutions in an equal and regular manner.

It will be observed, also, that it is perfectly symmetrical in all views, and that there are no steam or exhaust-pipes visible on the exterior. A heavy bed plate, serving as a base, of 12 inches elevation, supports the frame and cylinders; it rests upon a brick foundation laid in cement, and secured by strong bolts built in. The steam passages have been cast in the bed-plate, to convey the steam to and from the chests and cylinders, which stand vertically upon it. The pipes which convey the steam from the boilers to the engine, are placed in a passage or chamber, built in the foundation, in which chamber the throttle valve, controlled by the governor, is placed.

The cylinders are placed eccentrically, within cylindrical cases, forming *jackets*, the intervening space, being the steam chest, containing the valve seats, and long slide valves, moved by the eccentrics, which are placed upon the shaft, immediately above; the eccentric position of the outer cylinder or jacket, allowing the required space on one side for the valve, and a sufficient space all round, for the channels and steam.

The cylinders are fitted over one another, with conical metallic joints, and the cylinder-covers contain stuffing-boxes for the piston and valve rods.

It is this position and arrangement of double eccentric cylinders, giving space for the valves, channels, and steam, and forming a jacket round the working cylinders, which is claimed as an economic novelty, simple in its form, easy of construction, and presenting on the exterior a plain bright surface, an important security from loss of heat by radiation, or condensation of steam in the interior; and finally, entirely divested of the usual disfiguring appendages of steam channels, pipes, joints, &c.

The piston-rods and guides are made of steel, the cross-heads travel upon the latter, with metallic packing of an improved alloy, with tightening screws. The pistons are furnished with what is termed steam packing; in other words, metallic plates, held against the surface of the cylinders by the pressure of the steam.

The triangles or stirrups, connected in the centre of the bow with the piston rods, are forged in one piece, and are planed up, and finished bright throughout.

A simple solid pitman forms the connection with the cranks, a double stub-end and strap connecting with the cross-head above, and a single one below, working on the wrist-pin.

The shaft and drum are supported on two cast-iron frames, which conform in general features to a pointed arch window, strengthened by panels, and enriched by columns, supporting the pedestals, and carried up to a finial; its exterior being decorated with appropriate crockets. The two frames are connected above the drum, by stays and braces, which are consistent with the style, so arranged as to afford space, within which the governor stands, centrally and appropriately, to regulate the motion of all that is below and around it.

The engine is moved by steam at a pressure of eighty pounds, and is intended to be run at fifty revolutions per minute; this rate of motion is maintained without the slightest vibration, jar, or noise, and is calculated to give a sufficient effective force

for all the heavy operations of the Mint. The power is applied, through the agency of belts, to the rolls, and other machinery, silently but efficiently, an evidence that in mechanics, as in moral science, the best effects may be produced with the least noise.—(*Franklin Journal.*)

THE AMERICAN REAPING MACHINE AN ENGLISH INVENTION OF THE YEAR 1828.

Sir,—Inventions appear to require a happy conjunction of times and circumstances, powerfully seconded by personal exertions, in order to flourish and bear good fruit. Inventions relating even to the most important interests of mankind, have in the first instance failed of success, whilst resting solely upon their intrinsic merits. It is only through the fostering influences applied by energetic minds and enterprising capitalists that they have been able to take root in pub-

lic estimation. But whilst we award to these, *the men of action*, the merit that is their due—whilst we praise the superior discernment which could at once see the wants of the age and the practical appropriateness of the things which were to supply them, let us not forget *the men of invention*, who, besides this provision of the mind, were endowed with the faculty of devising the means which the exigencies of the times required. To refrain from recognising their true position in regard to the inventions of the day, were often to deprive them of the only reward they were ever destined to receive. Whilst we bestow on Fulton the honour that belongs to him, as an energetic and foreseeing man, let us not forget the claims of Symington as being the real inventor of steam navigation. So also in respect to another invention, which the more pressing wants of the inhabitants of the United States have induced them to foster, until its success and notoriety have landed it in the very country which gave it birth—I refer to the so-called American Reaping-machine —let it not be forgotton, that not only is it an English invention, but that it was first given to the world in the pages of your Magazine. From the time that I first saw the machine, I have been haunted with the shadow of a recollection that it was an old invention of our own; and I have now discovered that it was described in your fifth volume, page 50, in the year 1825.

The inventor was a Mr. Henry Ogle, of Erington, near Alnwick, in Northumberland; and from the history he gives of the machine, it appears to have been brought into actual, and even very successful operation, having cut the corn and laid it in sheaves at the rate of fourteen acres a day. In all its principal features it is identical with an American machine, and these are of that particular character which make it hard to believe, especially when we consider that their combination is also precisely the same, that the latter is a re-invention. There is the oscillating motion of a knife, with teeth in advance, in connection with which it acts; and there is a revolving beater to lash the corn back upon the knife. The position of the horse is sideways of the frame; and there is a contrivance to collect and discharge the corn in sufficient quantity for a sheaf,—but says the inventor, "It was found however to answer better when the corn was put off by a man and a fork, towards the horse, as it is easier bound, and leaves the stubble clear for the horse to go upon." The only difference I perceive is in the means of oscillating the knife, which in the American machine is more mechanically arranged.

Although the awards of the juries of the Great Exhibition are, theoretically at least, to be received simply as certificates of a certain degree of merit in the articles that came before them, and not as judgments on their relative merits individually compared, much less as decisions on questions of originality; yet as this principle is somewhat refined, and moreover, has not been steadily kept in view, either by the public, or by the juries, or indeed by the Commissioners themselves in the regulations sanctioned by them, this want of perspicuity of apprehension and inflexibility of purpose will issue in manifold injustice both to nations and individuals. It is to be hoped, however, that in the present instance this communication will be in time to afford an opportunity of inserting in the forthcoming volumes of the report of the juries, a notice disclaiming the award to the American Reaping-machine as having been given on the ground of originality.

I am, Sir, yours, &c.,

BENJAMIN CHEVERTON.

CHESS.*

Whatever be a man's occupation, generally speaking, he at intervals stands in need of some relaxation. The body requires repose as well as nourishment for the due performance of its functions. The mind, in like manner, must have its refreshing rest, its proper pabulum, and, occasionally, its exhilarating plaything to sport with and to unbend itself, in order to maintain its vigour and elasticity. An unceasing round of labour, either bodily or intellectual, would exhaust the subtle fluids which maintain both in condition for action, and render them torpid, inflexible, and incapaci-

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* I. "The Chess-player's Hand-book." By Howard Staunton, Esq.
II. "The Chess-player's Companion." By the same Author.
London: Henry G. Bohn, York-street, Covent-garden.

tated. "*Otiare quo labores*," truly says the fabulist, which, in homely English, means—"All work, and no play, makes Jack a dull boy:" this is an every-day truism, but it is an universal one. Be the employment mental or manual, the "*ne quid minis*" maxim applies; in either case, "too much of one thing is good for nothing." This is true even in youth, when all is jocular and buoyant; but when people arrive at the shady time of life, the truth of old Horace's apophthegm, "*Dulce est desipere in loco*," is exemplified every day.

When friends meet for social enjoyment, how much the stock of pleasure is reciprocally increased when each person can take a part in some harmless amusement. The great aim of education should be to make mankind useful and happy. When, therefore, so much familiar enjoyment may be obtained—at a time, too, when it is most wanted, and most difficult to be acquired—clearly little accomplishments for amusements should not only be allowed at school, but, with becoming caution, they should be inculcated. The same lesson that impressed the advice, "in summer prepare for winter," should also convey a warning of the pernicious and ruinous consequences of idleness and gambling. Innocent amusements should be taught to be regarded with some esteem—vicious gambling to be abhorred and shunned. Admitting that some preparation for the dark days of our pilgrimage should be made in the sunny ones, and that a small stock of accomplishments should be laid up which may, and commonly do, add much to sociability, what games or amusements, as the elements of such sedentary sources of enjoyment, may youths, with the greatest safety, be permitted to learn? We think the game named at the head of this article, without any comparison, must be placed first and foremost. As a mental discipline, it is without a rival or competitor. Its very essence is caution. It inures the mind to anticipate stratagems and to prevent them: it tends, perhaps, more than any other exercise, to induce a habit of foreseeing, and a promptitude of at once defending and defeating. The chess-player's skill at the table is of the same description as the general's in the field. The former may justly say, "*Ludimus effigiem belli*;" their professional characteristics are nearly alike,—each endeavours to dispose the lines of operation in the most advantageous manner,—each, as skilfully as he can, concentrates his forces so as to bring them to bear, with the greatest rapidity and effect, upon the most important points of the enemy's operations,—each endeavours that the plan of attack shall also form the best possible line of defence,—each *should* accustom himself to act with decision on pressing emergencies and on the happening of unforeseen incidents, —each should discover, from the slightest indications, the designs of the enemy,—and each should maintain his self-possession and imperturbed coolness in the fiercest attack or most bewildering strategy. This is comparing great things with small; but we believe the comparison to be strictly legitimate, and that it is generally admitted to be just. We here adduce it as an illustration of the inherent value of chess as a mental training, and as a fascinating and intellectual pastime, which the Egyptians are said to have ranked in the *number of the sciences*, and the invention of which Mr. Wharton calls an admirable effort of the human mind.

Chess, according to the most authentic testimony, was invented in India, in the sixth century. The following account of its origin may be mythological, but it conveys a moral which should be heeded, and may be useful at this juncture, when the destiny of nations and the peace of Europe appear to depend on the unrestrained will and the morbid ambition of a reckless and unprincipled adventurer. It is taken from Mr. W. S. Kenny's Chess Exercises:—"In the beginning of the sixth century of the Christian era, there was in the Indies a very powerful king, whose dominions were near the mouth of the Ganges. This monarch took to himself the proud title of King of the Indies, and soon forgot the interests of his people, in whom consisted all his strength and power. A Brahmin, or Indian philosopher, named Lissa, touched with the misfortunes of his country, undertook to make the prince sensible of his conduct. Instructed by the fatal example of those who had already admonished him, the Brahmin was convinced that his lesson would not prove of any service until the prince should make the application of it

to himself. With this view, he invented the game of chess, wherein the king,—though the most considerable of all the pieces,—is both impotent to attack as well as to defend himself against his enemies, without the assistance of his subjects and soldiers. The new game now became famous: the King of the Indies heard of it, and pitched upon the Brahmin Lissa to teach it to him. Under the pretext of explaining the rules of the game, and showing him the skill required to make use of the pieces for the king's defence, Lissa made the prince perceive and relish important truths, which he had hitherto refused to hear. The king, naturally endowed with virtuous sentiments, applied the instruction to himself; and now, convinced that in the people's love of their sovereign consisted all his strength, by a change of conduct regained the affections of his people. The king, out of gratitude, left to the Brahmin the choice of his reward, who desired that the number of grains of corn which the number of the squares should produce might be given to him—one for the first, two for the second, four for the third, and so on, doubling always to the sixty-fourth. The prince, astonished at the seeming modesty of his request, granted it, and ordered his treasurers immediately to pay the sum; but when they had made the calculation, they found that he had promised more than his vast treasures and dominions could pay. Then the Brahmin gave him to understand of what importance it was to kings to be upon their guard against the solicitations of their ministers and courtiers."

Chess is more universal than any other pastime, and one of its ennobling peculiarities is, that it is purely a mental contest—a battle of intellects; and it is on this account that we have introduced the subject to our readers. It is this characteristic which confers on chess the pre-eminence as an amusement which so justly belongs to it; and it is for this reason that we think Mr. Staunton has done good service to his countrymen by popularising the game, and putting it in such an attractive form. Its friends and promoters, however, should watchfully guard it against everything approaching to gambling contamination. There can be no reason why professional chess-players should give their time for nothing; but at the divans and other places, it would be more desirable that learners should adopt some other mode of payment than playing for stakes: the practice rather taints the noble game, and, to some extent, reduces it to a gambling contest for money. We trust that the real friends of this intellectual amusement, whilst they deal liberally with its professional teachers who deserve encouragement, will discountenance and denounce every attempt to make it a mere money-grubbing game, come from what quarter it may. As we have remarked, its great and distinguishing characteristic now is, that it is unalloyed with that debasing and truly horrid gambling particularity which is attached to cards, and to many other games which, in themselves, would be otherwise harmless and interesting.

We have reason to know that this truly rational and intellectual pastime has become much more prevalent in this country during the last twenty years than it was before. The two books before us are exceedingly well adapted to extend it further still. Mr. Staunton is a most accomplished player himself, and thoroughly imbued with a proper regard for his favourite subject. He has condensed an immense mass of useful information and valuable instruction on the topic, and places it before his readers in the clearest light. The author is not only a chess-player of the highest order, but he is a perspicuous writer on the subject: he knows what he writes, and he has a very happy manner of writing it. Each of the books mentioned is got up in Mr. Bohn's neatest style; they are sufficiently elegant for a nobleman's table, and are published at a price which puts them within the reach of almost every one. The author and publisher, for their endeavours to instruct and please the public, ought to find, and we trust they do find, their reward in an extensive demand for the works.

The book that we have named first is a complete *vade mecum* for the chess student. It comprises all the necessary elementary instruction — the various openings, with illustrative games; the different gambits and endings of games. There is also a very large number of games which have been played by the most celebrated players in this country and on the Continent; with notes stat-

ing the author's opinion upon certain moves. We fancy the games of chess, as published in some books, are made to sell; they appear to have been formed much in the same way as a writer makes Peter and John argue with each other; Peter is made to reason so that John must get the best of it—exactly in the same manner, one player is made to play so that the other may win—otherwise it is impossible to say why certain stupid moves were made. Mr. Staunton's games are generally free from this trait, and very instructive. There is one peculiarity in Mr. Staunton's books which considerably enhances their value. We mean the notation he has adopted in giving his games. If any one will turn to the article "Echecs," "Dictionnaire des Jeux," to "Philidor," &c., the advantage of Mr. Staunton's notation will be readily perceived.

The second book mentioned, "The Companion," is intended as a book of exercises for learners of the game who aim at proficiency. It contains a very large number of games played by the author and others at various odds; and of games classified according to their particular openings. The great chess match between England and France, which was decided by the author's defeating M. St. Amant is given. These games are particularly interesting, inasmuch as the time occupied by each player in making certain moves is given.

There are various other games played by the author with Mr. Cochrane, Captain Evans, Mr. Harrwitz, &c. This latter gentleman has gained considerable celebrity by his feats at playing chess blindfolded. Writers on chess relate as a sort of prodigy that Sacheri, a Jesuit of Turin, who possessed a most surprising memory, could play at chess with three different persons without seeing either of the boards. His representative merely informing him of every move of his adversary, Sacheri would direct him which piece to play, and conversed with the company all the time. If there happened a dispute about the situation of a piece or pawn, he would repeat every move made by the parties from the beginning of the game, in order to ascertain the situation where the piece ought to stand. We believe Mr. Harrwitz, at Glasgow and other places, has even exceeded this apparently astonishing power of memory. Mr. Harrwitz, however, has competitors in these wonderful memory achievements. Mr. Drewe, of St. John's-wood Academy, can perform the same exploits—at least, nearly the same. We happened to meet him a few months ago in Exeter, where he played two games at once, blindfold, with two of the best amateur players in that neighbourhood. One of the players was beaten at the end of three hours and a half; to the other, at the end of five hours, Mr. Drewe resigned. During this long contest, we could not see that the blindfolded player had in any manner missed a clear perception of the true position of the games; up to the time of his making a slight slip, which enabled his keen-eyed and wide-awake opponent to go a-head, we could not perceive that Mr. Drewe had made the smallest error. We do not know any writer on mental philosophy who has attempted to explain the process by which such astonishing performances are accomplished. When various pieces have again and again been moved into different positions—many taken—the kings castled, &c., &c., the power of holding all this in the mind, on several boards, must be immense. We fancy the abstraction must be much of the same kind as that which enables a person to multiply six or eight figures by as many different ones, and to say what the product is—this power we happen to know can be increased almost *ad libitum* by practice; the process of multiplying soon becomes easy, but the greatest stretch is in counting up, or finding the result. We have been given to understand that Mr. Drewe is engaged upon a work for publication, in which he intends to give some account of the mental process by which such powers are acquired; we think if he treats the subject correctly and philosophically, that his book will be interesting and instructive. If it depends upon any sort of discipline or preparation, Mr. Drewe is well qualified to state what it is; and unless it can be so acquired—if it rests on any peculiar intellectual faculty, such as that which once enabled George Bidder to make such surprising calculations—though he could not describe how he did it; writing on the subject will be of little service—nevertheless we shall like to see Mr. Drewe's work. We have not

however, adverted to these singular performances by way of inducing our readers to become the rivals of Mr. Harrwitz or Mr. Drewe. If their achievements in this way result from any peculiar and uncommon mental power which they possess, there ends the matter; but if it requires any sort of preparation, it changes the aspect of the thing. In that case, whilst these gentlemen excite our astonishment by their powers of intellect, we should be inclined to think that it is a waste of mental strength—it is the employing a fifty-horse power of the brain to crack a nut of amusement. We admire the uncommon gift; but, upon the *cui bono* principle, we do not profess to feel much regard for its application. Unless the feat depends upon some uncommon and spontaneous faculty, it is converting the most precious mental gifts into mere matter of wonderment—not exactly unlike a man's walking with his head downwards, or eating knives and forks; still the high and rare intellectual force is spent to very nearly as little utility. Whitehead's poem of "The Youth and Philosopher," with respect to the skill and judgment thrown away and the time profusely squandered — supposing that these chess feats are the result of mental exercise—would not unfairly apply to such an immense stretch of intellectuality for such a purpose. Heaven's rarest and highest gifts, in our opinion, should not be wasted in aimless display, which proves that the exhibitor possesses enormous powers of memory and abstraction, and that he throws them away simply upon matters of raree-show. If any of our readers should fortunately be endowed with such rare gifts, we trust that they will husband them for some more befitting employment. Our aim in introducing the game of chess to their notice has been not to lead them to waste their time in such displays, but to advise them to make themselves acquainted with, at any rate, the elements of this intellectual amusement, and taking to this notion the fact that Mr. Staunton in his "HAND BOOK" will give them every information on the game in the neatest manner, at the cost of five shillings; and that if they wish to make themselves proficient in the pastime, for another five shillings, they may obtain the "COMPANION," and thus become possessed of a chess-player's library.

HJORTH'S ELECTRO-MAGNETIC ENGINE.

Sir,—Will you permit me to subjoin a few remarks to those of your Birmingham correspondent, relative to electro-magnetism, which were inserted in your Journal of the 10th inst. I was not aware, until I saw that communication, that such a disastrous attempt had been made as to construct a working engine on Hjorth's principle. It would not be difficult to show, theoretically, that the increase of battery surface must, according to that plan, be as the square of the size of the labouring force; and, taking the amount of battery surface required to work the model, of which we were permitted a glance at the Exhibition, at a minimum, the increase of the size of the different parts to represent a four horse-power engine would require an amount of battery surface altogether destructive of any hope of employing this interesting source of power economically. Truth, however, in this case, as usual, lies between two extremes; and the failure of the plan alluded to cannot be construed into a legitimate discouragement for the application of other methods, founded upon principles which the artizan and the analyst alike admit as correct, and employ as such every day in their several departments. Let a bar of soft iron be held within a quarter of an inch of Henley's large electro-magnet, acted upon by two small Grove's batteries, and the most sceptical must allow that a prodigious attractive force is exerted at that distance with comparatively small expenditure of material. Indeed, with a due regard to Chin's theorem, and a judicious application of simple mechanical artifices, I venture to be more hopeful than your correspondent as to the extensive application of electro-magnetism as a motive power. The difference between the space occupied by coals and the zinc necessary, according to Page's Researches,* to work one of our transatlantic steamers, (the *Asia*, for instance) amounts, for each voyage, to 800 tons, available for passengers, cotton, or even gunpowder;

* *Philosophical Magazine*, Feb., 1851. Paper on Professor Page's Researches.

and, calculating these at the low rate of 4*l.* per ton, we have 3,200*l.*, a sum, with the price of the coals, abundantly sufficient to pay for the zinc consumed, and afford enormous additional profit. But I find that I have already trespassed on your time beyond proper limits, and must not enter into further calculations.

I am, Sir, yours, &c.,

VERITAS.

Chiswick, Feb. 10, 1852.

PROTECTION OF STEAM SHIPS. — EXTINGUISHING OF FIRES BY STEAM.

Sir,—In your last Number, p. 116, your correspondent, Mr. Stenson, suggests the employment of steam for the purpose of extinguishing fires in steamboats. As there are at this time several other claimants for this as *a modern discovery*, permit me to refer them to the Report of Captain Pringle, R.E., and Josiah Parkes, Esq., C.E., "On the Causes and Means of preventing Steamboat Accidents," a very full notice of which appeared in your thirty-first volume (1839).

Among other plans for checking the progress of fire, the reporters observe that, "The suggestions of Messrs. Maudslay and Field, *and others*, that pipes from the boilers should be so arranged as to convey steam into the coal receptacles, and other parts of the vessels, in the event of fire, would give great additional security."

Mr. Stenson says, on breaking out of fire, "its immediate suppression would be certain and instaneous, if steam was let into the burning compartment." But the fact is, that the extinguishing powers of steam have been greatly overrated. All the experiments, conducted upon a sufficiently extensive scale, have tended to show that steam will rapidly extinguish *flame*, but that if combustion has proceeded so far as to resemble a *coke* or *charcoal* fire, the steam is partially decomposed, and aids rather than checks the progress of combustion.

In the combustion of gas, or of light inflammable substances (as wood or paper shavings, lace, muslins, &c.), or of fluids (as spirits, turpentine, &c.,) in confined places, the mere exclusion of the atmosphere, or its displacement by steam, carbonic acid, or other gas inimical to combustion, will cause the fire to go out. In all places, however, in which there is a free communication with the atmosphere, or a large mass of solid matter in active and violent combustion, water alone can be relied on for its "certain" and "immediate" suppression.

Thus it happens that in the use of Phillips's (so-called) fire annihilators upon fires of the latter description, as much water is eventually required to *finish putting out the fire*, as would have sufficed for its entire extinguishment.

In the Report above quoted, the disasters by fire are mainly attributed to the circumstance of steam vessels going to sea without a *portable fire-engine* on board, and it is therein recommended that:—

"All steamers be provided with sufficient hoses to convey water to any part of the vessel, with a serviceable outfit of water-buckets; and a moveable fire-engine to be carried in all coasting, channel, and ocean-going steamers."*

Compliance with this excellent precaution *saved* the *Great Western* and the *Sirius*;† disregard of it led to the *loss* of the *Amazon*.

I remain, Sir, yours, &c.,

WM. BADDELEY.

29, Alfred-street, Islington, Feb. 9th, 1852.

A NEW ROTARY ENGINE.

Sir,—You did me the favour to insert in your Number of the 20th of December last, an account of a cheaper method of propulsion for railways, suitable for branch lines, and in which a kind of locomotive was described, adapted to be worked by compressed-atmospheric air, instead of steam. I now beg to hand you a plan and description of a wheel, which I think still better adapted to the purpose than the one there described, the description is as follows:—

All the parts of the wheel are hollow, hollow axle, hollow spokes, and hollow rim.

Fig. 1 represents the hollow axle of the wheel, in the middle of which there is a transverse plate fixed, called a "stop plate," S. P.

The spokes, which may be of any number, are fitted, half the number on

* *Mech. Mag.* vol. xxxi., p. 285.

† Ibid, vol. xxix., p. 5.

one side of the stop-plate, and the other half of the number on the other side, so that they are off the centre on the axle, as represented by the dotted lines, fig. 1. These spokes are hollow and fitted to the rim, as seen fig. 2.

Fig. 1.

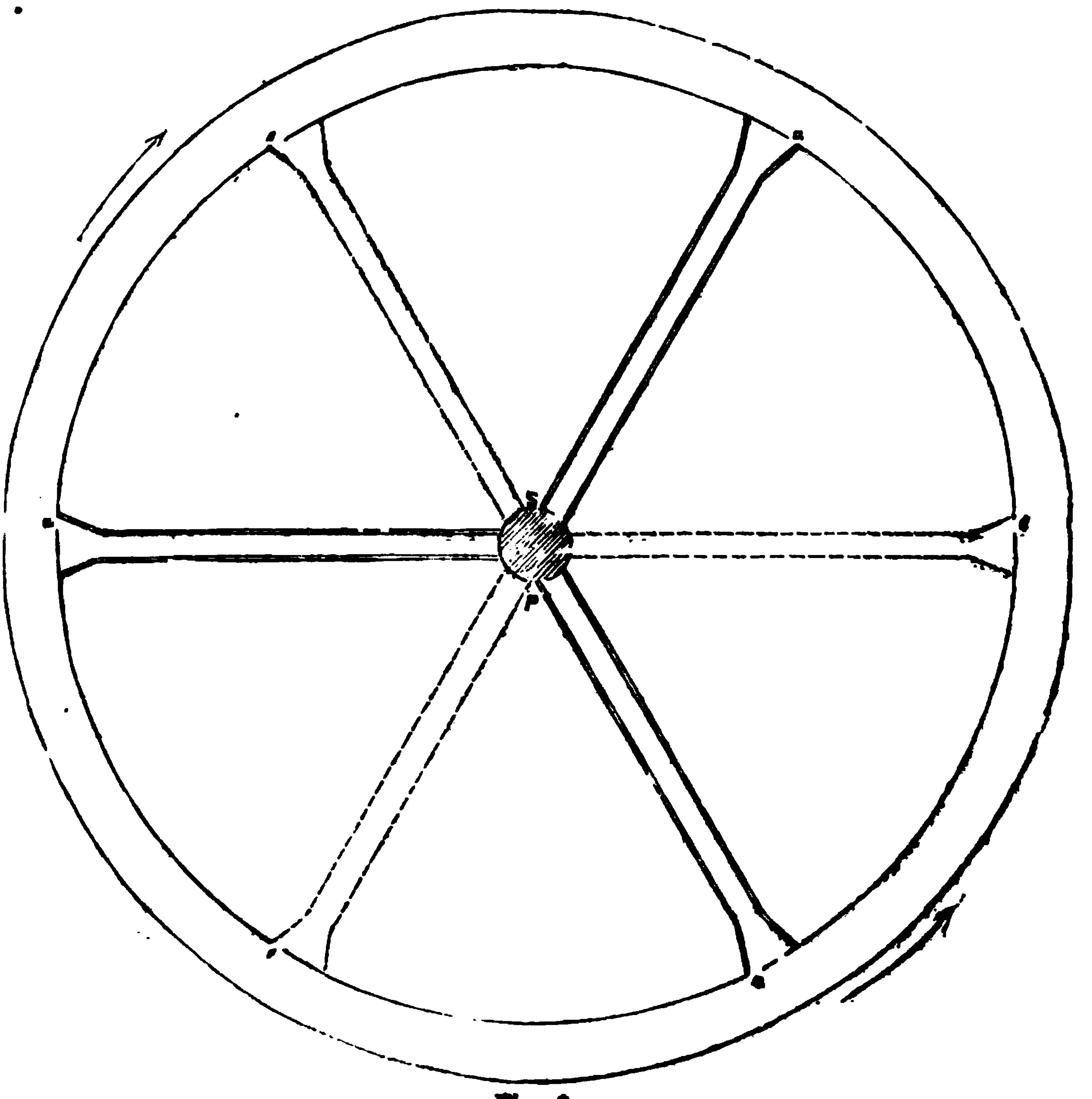
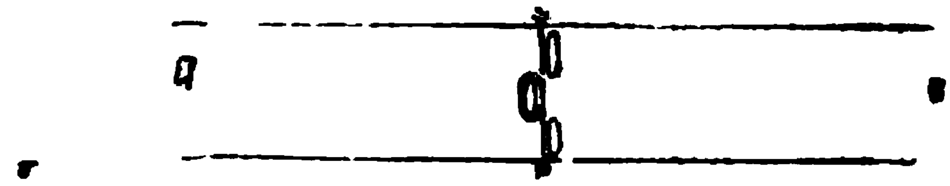


Fig. 2.



The rim is hollow and smooth throughout, so that there is a clear passage quite round. There is a communication between the spoke and the rim, by a small aperture, about one-fourth of an inch in diameter, perforated at right angles to the spoke, through the inner metal of the rim, (see *a* and *e*, fig. 2). The spokes on one side of the stop-plate have their apertures opposite to those of the other, that is, the apertures *a a a*, are on a different side of their spokes to the apertures *e e e*.

The following is the course the steam would take. If issuing from the boiler, it would enter the hollow axle of the wheel at B, and would rush on in a straightforward direction until it met with the obstruction offered by the stop-plate, S. P.; it consequently could not proceed any further in a straightforward direction, but would pass along the spokes distinguished by double lines, and issuing out of the orifices at their extremities, would fill the hollow rim of the wheel. Having filled the hollow rim of the wheel, the steam would pass through the orifices of the dotted line spokes, and

passing along the spokes themselves would enter the hollow axle of the wheel again on the far-side of the stop-plate, and would pass along the hollow axle at C, fig. 1, to the condenser or chimney. In taking this course, the steam will cause the wheel to revolve in the direction of the arrows. In issuing from the dotted line spokes, it would repel them from it, and in entering the orifices of the dotted line spokes it would draw these towards it; hence the necessity of the one set of spokes having their apertures on a different side from those of the other.

This engine requires great pressure, and can be worked by steam, air, or water. And though the pressure required to work it must be very great, the quantity need be but small, so that the expense of fuel would probably be less than in an ordinary steam engine. By making the driving wheels of locomotives on this construction the steam may be admitted into them at once, or they may be worked by compressed-atmospheric air instead of steam. The wheel is easily capable of rotating at the rate of eight or ten miles per minute. There is no reciprocating action in it whatever, *there not being even any valves*, and there is little doubt that a locomotive constructed on this principle would traverse on a suitable railway at the rate of 200 or 300 miles per hour. Railways to India are already spoken of; and if ever we are enabled to reach that distant country in the course of a few hours, it will probably be by means of this engine, or one of similar principle. The knowledge of an engine of such capability would tend more than anything else to bring this desirable undertaking into favourable notice. This engine is, of course, suitable to other purposes to which the steam engine is applied; but of these it is not my present purpose to speak. I remain, Sir, yours respectfully,

M. G.

CHATTERTON'S PATENT METHOD OF PROTECTING INSULATED TELEGRAPHIC WIRES.

(Patentee, Mr. John Chatterton, of Birmingham. Patent dated June 12, 1851. Specification enrolled December 12, 1851.)

Specification.

Of the various substances or combinations of substances hitherto employed for the insulation of electro-telegraphic

wires, the most perfect, and at the same time most easy of application, is gutta-percha. But the gutta percha requires to be protected from external injury, and from atmospheric influences, and no means entirely satisfactory have been yet devised for the purpose. Iron-wire rope has been wound round the gutta percha, but it is liable to the objection of the probability of air and water finding their way between the strands of the rope, especially under circumstances of great strain and pressure. It has been also proposed to enclose the gutta percha in leaden tubing, but it is essential that the metal should be in close and uniform contact with the gutta percha, and this can only be well accomplished by drawing the tubing while in the course of formation, or as fast as formed, over the gutta percha covered wire; but as such tubing is now ordinarily manufactured, the metal, when forced out from the machine by which it is formed, is at so high a temperature, that it would injure the gutta percha. The use of leaden tubing for protecting gutta percha covered wires has therefore been hitherto found impracticable, though lead is, on account of its ductility and (comparative) impermeability, probably superior to any other metal for the purpose.

Now, my invention consists in an improved arrangement of machinery whereby leaden tubing is, as fast as produced, so lowered in temperature, as to be brought over the gutta percha covered wire without injuring the gutta percha. A top plan of this arrangement is exhibited in the engraving. A represents the delivery-end of a hydraulic lead pipe-making machine of the ordinary description (as to which by itself I make no claim). A^a, a long rectangular framework, which carries the additional parts which are new, and of my invention. BB, are a series of friction-rollers, which are mounted in the framework, A^a, at about 15 inches apart; C, represents the gutta percha covered wire, which is required to be protected, and which is borne by the friction-rollers, B^1, B^2, B^3, B^4, &c.; D, the end of the core on which the leaden tubing is formed; and E, a thin wire, by which C and D are connected, which passes over the rollers, B^{10}, B^9, B^8, B^7, B^6; F is a trough through which a stream of cold water is kept constantly flowing, into which the portion of the connecting wire between B^7 and B^8 is immersed; G is a wooden drum, which is mounted on a square spindle a little in advance of the water-trough, and rests in slotted bearings, so as to admit of its being lifted up and removed as required; H is a spur-wheel, which is attached to one end of the drum spindle, and gears into a pinion on the end of a second spindle H^2, to the opposite end of which last, a winch-handle K, is attached. The mode of operating with the apparatus is as follows:—As the tubing is forced from off the core D (by hydraulic pressure, as usual), it passes along the connecting-wire E, and through the water-trough F, and thence onwards to the gutta percha insulated wire C, by which time it is so cooled down as to be brought into contact with the gutta percha without danger of injury to the latter. At this point the tube has a chain or cord attached to the end of it, by which it is easily conducted over the insulated wire. When any given length of the insulated wire has been thus covered with tubing, it is cut off, and passed through a die, or set of grooved rolls placed at M, by which complete contact between the metal and gutta percha is effected. From the die, or rolls, the protected wire is carried forward to the drum G, and wound upon it by turning the winch-handle K; and when the drum is full, it is lifted out of its place, and an empty one substituted for it, and so on. To join any two lengths of wire which have been thus insulated and protected, I cut away the lead and gutta percha at the ends to be joined, for about a couple of inches, so as to leave about that length of copper wire bare. I then tie, twist, and solder together the two exposed ends of wire, and make good the gutta percha to the same size as the leaden tubing. I next slip a socket, or coupling joint, about 5 inches long, over the ends of the two lengths, and solder it to the leaden tubing by means of a blow-pipe, or copper bit (preferring to use for the purpose a quickly-fusible alloy). The instant the joining is completed cold water is thrown over it, so that the gutta percha is not at all injured by the heat. In the same way any number of lengths of wire may be joined, and thus a continuous wire of indefinite length pro-

duced. Instead of passing the leaden tubing through water, as before described, it may be exposed during its passage along the connecting wire E, to a current of cold air, but this method I regard as less certain than the other, and do not therefore recommend. Instead also of the lead tubing being drawn over the insulated wire in the manner before described, the insulated wire may be drawn through the tubing, by the following modification of the process. The tubing may be first drawn to the required length as it is formed over a plain wire, and the end of that plain wire attached to the end of the insulated wire; then on withdrawing the plain wire from the tubing, the insulated wire would follow and occupy its place. The tubing with the insulated wire thus introduced into it may then be passed through a die, or between grooved rolls as would be the method first described. But this plan is much more operose, and tedious than the other. When two or more wires are required to be enclosed in one tube, I insulate each wire with gutta percha or other analogous material independently, and then twist them together, so as to form a rope, which rope is then subjected to the same process as before directed to be employed in the case of a single wire.

THE OPERATIVE ENGINEERS' STRIKE. SECOND LETTER.

Sir,—The inquiry into the "Relative Claims of Capitalists and Labourers," involves difficulties of all sorts, moral and political. Questions of casuistry are mixed up in it with questions of political economy. The provinces of the clergyman and of the purely scientific inquirer are both invaded, as well as that of the legislator. In my last letter I quoted a speech of one of the operative engineers, in which the "breathless struggle for wealth among the masters," was denounced as energetically as any popular preacher could do it from the pulpit. And this "breathless struggle for wealth," is not only a good subject for pulpit declamation, but a very curious subject of investigation as to its results, considered in a purely scientific point of view. In its former capacity, as a subject for declamation, everybody in turn may become the preacher, and inveigh against those above him in the social scale. When the operative engineer has finished his sermon against his employer, the unskilled artizan may mount the rostrum and preach against the engineer; and when he has done, the common labourer may get up and declaim against the artizan. And so on down to the common pauper, who with equal reason and justice, may denounce the grasping selfishness of all the rest of the community, which has thus left him without a farthing. The employer of the engineer may also, in his turn, abuse the banker for charging so high a rate of interest for his money; one capitalist may feelingly point out the avarice of others; and so on *ad infinitum*.

It is very natural, certainly, for the operative engineer to "think it very hard," that he should receive so small a share of the profits of his employer; and should have to work so hard for what he does get. But is it not still harder that so many thousands of men, able and willing to work, should not be able to earn a bare subsistence by any efforts? The operative engineers are princes compared with the great mass of labourers, both in point of pay and work. Still, it may be said, the injustice of the case is not removed by bringing forward other cases of greater injustice. The operative engineer will say, "It is of no relief to me, to tell me that others are *oppressed* as well as myself." True, O engineer! But we must, if possible, have two points clearly stated, understood and settled, before we can go any further. And these two points are,

1st.: *Is* there any injustice or oppression, in either your case, or any other case of which we have been speaking? If so, then,

2nd.: What is the *Remedy?*

Let us consider each point separately. And in the first place, let us suppose there is a capitalist who employs his money in establishing a manufactory, of steam engines, say. Now, here to begin with, let us ask the question, Was he bound to employ his money in this way at all? Would it have been wrong in him to refrain from embarking in this, or any other commercial pursuit? If not, then, of course, it would not be wrong if all other capitalists did the same; that is, if all the moneyed men in

the kingdom chose to spend their money in eating and drinking, &c., what would become of the operative engineers in that case? or any other operatives?

They would be ten thousand times worse off than they are now, and yet would have no right to complain. This may seem a farfetched and impossible case, and so it is; but it shows the real nature of the question we are dealing with, and the principles which lie at the bottom of it. If it be once granted that no man is obliged, by any law of justice or conscience, to employ his capital in commerce at all, then it follows inevitably that the rest of the community would have no "*right*" to complain, even if not employed at all. The most they could claim would be a bare subsistence as idle paupers. But many of my readers will not "grant" the above proposition at all. They will contend that every man *is* bound to employ his money, not for his own private enjoyment alone, but for the public good. Very well: I neither contend for or against it; but I wish the reader to see what sort of "questions of conscience" are involved in this dispute. Most labouring men will say, "I am willing to work, and *therefore* I have a *right* to be employed." Let this be granted. The next assertion will be, "And I have a right, also, *to a fair day's wages for a fair day's work*." Now, my good man, whether you know it or not, this is "communism;" and the logical practical result would simply be, to throw all the property in the world into a common fund, whence every man should receive an equal share. For, just consider a moment. The phrase you have used—"A fair day's wages for a fair day's work"—sounds uncommonly plausible and honest; but when we come to the practical working out of the matter, just see what would happen. The agricultural labourer would think he had a *right* to as good wages as the engineer. The engineer would think he had a *right* to "share and share alike" with his employer. Everybody would insist on having as much and doing as little as anybody else. Neither would any one be at a loss for plausible reasons for his demands. For instance, the agricultural labourer and the operative engineer would debate the matter thus:

Agricultural Labourer: "Why should you be getting thirty shillings or two pounds a week, whilst I get only ten shillings? I work as hard, or harder than you do. It isn't fair at all."

Operative Engineer: "A pretty demand, truly! You, a mere clodhopper, to ask the same wages as a skilled artizan like myself! It is my skill—my superior education and abilities—that entitles me to higher wages."

Agric. Labourer: "And pray what *right* have you to be thus superior to me in education or ability? If it were not for the unnatural state of society, and the oppression of the rich over the poor, *I* should have been as well educated and as skilful a man as yourself. You are only defending one injustice by another. Give me my *rights*, and I will soon show you that I am as good a man as yourself, and entitled to as good wages, too."

The engineer would think this very impudent and unreasonable; and, with equal cause, everybody would think everybody else impudent and unreasonable who presumed to claim sixpence more than himself on any ground whatever. And so, as I said, we should arrive at a universal equation and a common division sum; the final result being, that each one of us would receive some few odd shillings, and henceforth live independent on our means, or die of starvation.

A. H.

(*To be continued.*)

MATHEMATICAL PERIODICALS.

(Continued from Vol. iv., p. 448.)

XXVII.—*The Mathematical Repository.—Original Papers Continued.*

Art. I., Vol. II., Part II. Demonstration of a Proposition in Mechanics. By A. B.

Art. II. On the Motion of Pendulums whose Points of Suspension are Moveable. In a Letter from Mr. John Gough.

Art. III. An Occular Demonstration of the Forty-seventh Proposition of the First Book of Euclid. By Mr. H. (now Sir Howard) Douglas.

Art. IV. An Investigation of some Theorems which are of use in obtaining the sums of certain infinite series by means of circular arcs. By Mr. James Cunliffe.

Art. V. An Investigation of some Theorems which are of use in obtaining the sums of certain infinite series by means of hyperbolic logarithms. By Mr. James Cunliffe.

Art. VI. Solution of a Dynamical Question from Atwood's "Treatise on Rectilineal Motion." By Mr. John Barry.

*** This question includes Simpson's Problem as a particular case, a solution of which may be seen in Art. VI., Part II., Vol. I., of the *Repository.*

Art. VII. Some properties of Parallelograms, with the application of them to the moments of forces. By Mr. John Gough.

*** This paper contains "a beautiful Theorem respecting the moments of forces," which "Mr. Gregory has given in his Mechanics;" but since the demonstration there given is derived "from the Arithmetic of Sines," Mr. Gough flattered himself that "the English reader will not be displeased to see this interesting proposition in a geometrical dress."

Art. VIII. Three Problems and two Examples illustrating the Use of the Mechanical Proposition in Art. VI. By A. B.

*** At the close of this article the writer remarks that "the sum of $1 + 4 + 9 + 16 + \&c. \ldots n^2 = \frac{1}{6}(2n^3 + 3n^2 + n)$."

Art. IX. A Diophantine Problem. By Mr. James Cunliffe.

Problem.

"To find values for the sides of a triangle in rational numbers, such that the lengths of three right lines from the angles to the middle of the opposite sides may be expressed by rational numbers."

*** Another solution to this problem appeared in Vol. I., Part II., Art. X., but "one of the sets of numbers here found are considerably smaller than those found in the article referred to."

Art. X. The Theory of Amicable Numbers. By John Gough, Esq.

Art. XI. A New Solution of a Problem in Insurance of Money on Lives; in which it is demonstrated that the Tables for that purpose now in use are deficient by about a sixty-seventh part of the whole. By Philalethes Cantabrigiensis.

Art. XII. An investigation of Theorems for finding the sums of certain Infinite Series, &c. By Mr. Cunliffe.

Art. XIII. On the Attraction of an Infinite Solid Elliptic Cylinder. By Mr Thomas Knight.

*** After determining the expression for the attraction of the Solid, Mr. Knight corrects an error made by Laplace in his investigation of the Figure of Saturn's Ring, *Mech. Cel. Liv.* 3, chap. 6.

Art. XIV. Two Indetermiate Problems. By Mr. James Cunliffe.

Art. XV. On the Proportionality of the Force to the Velocity, and on the Composition of Forces. By Mr. Knight.

Art. XVI. On the Composition of Rotatory Motions. By Mr. T. Knight.

Art. XVII. On the Expansion of Certain Functions. By Mr. Knight.

Art. XVIII. On the Expansion of any Function of a Multinomial. By Mr. Thomas Knight.

*** These expansions are contained in two letters to the Editor, and are intended to furnish other demonstrations, &c., than those given by M. Arbogast in his "*Du calcul des Dérivations.*"

Art. XIX. Demonstration of a Theorem in the Diophantive Analysis. By Mr. Peter Barlon.

(*To be continued.*)

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING FEBRUARY 10, 1852.

JAMES WHITELAW, of Johnstone, Renfrew, engineer. *For certain improvements in steam engines.* Patent dated July 31, 1851.

We give now the claims of this specification, and hope soon to be in a position to lay before our readers a fuller description of some of Mr. Whitelaw's improvements.

Claims.—1. The systems or modes described of constructing steam engines, and the general arrangements connected therewith.

2. The employment and use of steam engines fitted with cranks of a length more than equal to half the stroke of the piston, for the purpose of enabling such engines to be driven at a higher rate of speed than can be accomplished with ordinary engines of a similar length of crank.

3. The combination of the respective advantages of long and short stroked engines in one engine.

4. The system or mode of arranging steam engines to work at a high rate, by causing a short-stroked piston to actuate a long crank.

5. The system or mode of securing the advantages of the effective leverage of a long crank with a short stroke of the piston.

6. The employment of beam or side-lever engines, in which the three centres of the piston-rod, connection main-centre, and connecting-rod centre are not in one plane, or at the same level, as a means of economising space.

7. A peculiar system or mode of arranging steam engines.

8. The use or employment of steam engines in which the two systems of placing the three working centres out of the same plane, and of what the patentee terms "differential" or unequally divided beams, are combined.

9. The system or mode of constructing steam engines with side-levers or beams working through or between each other.

10. The system or mode of adapting steam engines for actuating screw propellers direct by means of the combination of a long crank with a short stroke of a piston.

11. The employment or use in steam engines of curved or bent differential beams or side levers.

12. The employment and use of steam engines constructed as described for propelling vessels, and other purposes.

13. The construction of steam engines wherein the piston-rod connection is placed between the fulcrum or main centre of the beam and the connecting-rod centre.

14. A system or mode of obtaining a superior length of connecting rod, and of lowering the beam, in steam engines.

15. The employment and use in steam engines of duplex or jointed connecting rods, and a system or mode of working the same so as to produce the same effect as that obtained from ordinary inflexible rods of a similar length.

16. The system or mode of constructing double-cylinder expansion, or Woolf's engines, wherein one cylinder is placed on each side of the main working centre of the beam—the effective leverage of each, or of the larger cylinder alone, being less than the effective working lever of the connecting-rod end.

17. The employment and use of two short-stroked cylinders, placed one above the other, to economize horizontal space in differential beam engines.

18. The system or mode of obtaining superior uniformity of rate in expansive steam engines, by providing that the momentum or inertia of certain of the moving parts shall equalize the varying steam pressure or action.

19. The system or mode of superadding weight to the pistons, working beams, or other moving parts of steam engines which are comprehended between the piston and crank pin, or of adjusting the weights of such parts, for the purpose of securing superior uniformity of rate.

20. The system or mode of regulating or adjusting the rate of steam engines, by the addition of a secondary action to the ordinary governing apparatus.

21. The system or mode of balancing the external steam pressure on the backs of slide valves by the action of fluid pressure from beneath.

22. A system or mode of constructing valved pistons or buckets, and other lifting or discharge valves.

23. The application and use of flexible rings or annular discs for buckets or lifting valves.

Charles Cowper, of Southampton-buildings, Chancery-lane. *For improvements in locomotive engines, and boilers, and carriages, part of which improvements are applicable to other similar purposes.* (Communication.) Patent dated July 31, 1851.

Claims.—1. A mode of applying a lining of fire-brick or fire-stone in the lower part of the fire-box of locomotive engines.

2. A mode of constructing the ash-pans of locomotive engines of a curved or dished form, and of applying two or more valves or dampers in the bottom of the same, whereby the warping of the ash pan and dampers by the action of the heat is prevented or diminished.

3. A mode of constructing the fire-box and body of the boiler of locomotive engines when the body of the boiler is completely filled with tubes. Also, a mode of applying two or more boiler bodies in connection with a single fire-box.

4. A mode of applying a steam channel of a semi-cylindrical or other suitable form on the top of the body of the boiler, for the exit of the steam.

5. A mode of introducing the feed water through several perforations at the end of the boiler farthest from the fire.

6. A mode of applying partitions in the body of the boiler, so as to cause a circulation and gradual heating of the feed water. Also, the carrying of these partitions into the steam channels before mentioned, so as to stop the passage of the water, and yet allow the passage of the steam,

7. A mode of applying an air vessel to receive the water from the tender, and supply it to the feed pumps of locomotive engines.

8. The application beneath the boiler of a mud chamber divided into compartments, each of which can be blown out separately. (Pebbles, sheet iron, or other matters, may be introduced into the mud chamber, for exposing an extended surface to receive the deposit.)

9. A mode of applying two or more chimneys to the boilers of locomotive engines, with a blast pipe to each chimney.

10. The application to the chimneys of locomotive engines of a disc damper, turning on a spindle, and entering a slit or notch in the side of the chimney.

11. The construction of the chimneys of locomotive engines in various forms shown, and the application of a lining to certain spark arresters, also shown.

12. The application to the blast pipes of locomotive engines of a slide or other valve capable of closing air-tight, and the adaptation of the same to open or close any one or more of two or more blast pipes of unequal size.

13. The application of a steam chamber or reservoir on the escape steam pipe of locomotive engines, for the purpose of regulating the blast and separating the water, grease, and other impurities from the steam.

14. The application, in the steam pipe leading from a boiler to an engine, of a regulator or valve, which closes in proportion as the slide valve opens, for the purpose of taking the steam off from the boiler in a more regular manner.

15. The application of a steam chamber between the regulator and the cylinder of a locomotive engine, so as to render more uniform the flow of steam from the boiler, and to render the steam more free from water.

16. The application, between the boiler and cylinder of an engine, of one or more regulating chambers, in entering each of which the pressure of steam is diminished, so as to regulate its flow from the boiler.

17. A mode of applying superheating steam chambers, or superheating and regulating chambers, in the smoke box or flue of a steam boiler, and a mode of applying superheating chambers to tubular boilers.

18. A mode of packing a spindle, by making a part thereof of a tapering or conical form, and causing it to be forced into a corresponding hole by the pressure of a spring, assisted by the pressure of the steam or other fluid to which it is exposed.

19. A mode of applying, in lieu of an eccentric, a counter crank, adjustable in length and position, for the purpose of varying the stroke and lead of a slide valve, and reversing its motion.

20. A mode of applying a counter crank parallel with the main crank of a steam engine, but longer or shorter than it, and carrying another small moveable counter crank, capable of being adjusted and secured in any required position, for the purpose of working the valve, and varying its stroke and reversing its motion.

21. The application of a double counter crank attached to the main crank-pin of a steam engine for driving and reversing the slide valve.

22. The application of a counter crank fixed to the main-crank pin of an engine, and carrying small additional counter cranks for working the slide and expansion valves.

23. A mode of working the slide valve and expansion valve by means of the same rod driven by the link motion, and the making of the expansion valve in two pieces, which are capable of being brought nearer together or removed further apart by means of a grooved plate, for the purpose of varying the expansion.

24. A mode of increasing the variations of velocity in the motion of the slide valves and expansion valves of steam engines.

25. A mode of regulating the supply of feed-water to locomotive and other boilers by working the feed-pumps by a variable lever, and driving such variable lever with a reduced motion from the cross-head of the engine.

26. The construction of the variable lever last mentioned, with a flanged slot to receive a small sliding block carrying a pin, on which is jointed the connecting-rod which drives it; and the making of this lever with a catch or catches for retaining the block in various positions. Also, the application of this arrangement to the slotted levers or links used for driving slide valves.

27. The construction of the axle-guards of locomotive engines, and carriages with flexible plates, or with plates jointed and provided with springs, for the purpose of diminishing lateral concussions.

28. A mode of constructing the axle-boxes and bearings of locomotive engines and carriages, so that they may bear on the collars at the ends of the axles as well as upon the ordinary bearing surface or journal. Also a mode of constructing the axle-boxes and bearings so that they may bear against the end of the axle, and also against the nave of the wheel.

29. The construction of the axle-box and crank boss of the driving wheels of engines with external cranks, so that the axle-box may bear partly upon the boss of the crank. Also the combination of this arrangement with dished driving wheels.

30. A mode of constructing the cranks and counter cranks, by making the crank-pin of the main crank in one piece with the first counter-crank, the first counter-crank pin in one piece with the second counter-crank, and the second crank pin in one piece with the third counter crank, when three are used. Also the application of loose rings with spherical peripheries on the crank and counter-crank pins.

31. A mode of fitting one wheel of a pair of wheels of a railway carriage loose upon the axle, and securing it by a ring and shoulder, or by two rings, while the other wheel is fixed upon the axle in the ordinary manner.

32. A mode of packing stuffing-boxes with a collar or bush of hard metal, or soft metal capable ot being compressed and squeezed up when worn. Also the application for a similar purpose of two or more metallic rings forced in opposite directions by springs, and confined by a plate also pressed up by a spring.

33. A mode of constructing springs for locomotive engines and carriages in such manner that the weight comes upon the plates successively in lieu of simultaneously. Also the making of the lower plates of such springs progressively thicker than the upper ones.

34. A mode of jointing the fore carriage or body frame of a locomotive engine or carriage by means of two pins working in transverse and longitudinal slots at the front and back.

35. A mode of constructing a break with a block or shoe without flanges, which is capable of being brought down quickly upon the rail by means of a grooved disc or cam, or a pinion and racks, and then forcibly pressed down by means of a screw, with the intervention of a spring to prevent concussion.

36. A mode of constructing tender locomotives with the driving wheels behind the fire-box, and a bogy frame in front of the smoke-box, and without any wheels between the fire-box and smoke-box, by which means the centre of gravity may be brought very low, notwithstanding that large driving wheels are employed. Also the application of two or more pairs of coupled driving wheels behind the fire-box of a tender locomotive, or the placing of some of the driving wheels before and some behind the fire-box, and coupling them together.

37. A mode of roofing over the tender and part of a locomotive engine, to protect the engine driver and the coke from the weather.

38. A mode of constructing the wheels of locomotive engines and carriages with tyres of a conical form, having an inclination to the horizontal of not less than 1 in 4, and with or without flanges.

39. The application of wheels with conical tyres, so that some of the wheels of a locomotive engine or carriage may have their tyres inclined in contrary directions to those of other wheels of the same engine or carriage.

40. A mode of applying, on the driving axle of locomotive engines, a pair of wheels, one of which is loose upon the axle, and the other fixed so as to facilitate the passage of the engine round curves in the road. Also, the application of two or more such pairs of wheels to the same engine, and the coupling together of those wheels which act as driving wheels.

41. A mode of constructing the wheels of locomotive engines with grooves in their tyres of such form that the sloping sides of the grooves may bear upon the rail, while the deepest part of the groove is out of contact with the rail.

42. A mode of causing a portion of the weight of a tender to rest upon a pulley or roller on each side of the framework of a locomotive engine, and also the application of a stud or tooth entering a hollow, for preventing side oscillation between the engine and tender.

43. A mode of applying steam jackets to the cylinders, cylinder covers, and valve boxes of steam engines.

44. A mode of constructing metallic pistons, more particularly adapted for small engines, or those which run at a great speed.

45. A mode of applying the governor of steam engines, to regulate the degree of expansion, by means of valve gear driven by counter cranks.

Joseph Mansell, of Red Lion-square, manufacturing fancy stationer. *For improvements in ornamenting paper and other fabrics.* Patent dated July 31, 1851.

These improvements consist in producing ornamental patterns or designs upon paper and other fabrics, which are capable of being glazed or glossed by pressure, by removing certain portions of the glaze, or glazing certain portions only of the surface, thus producing a finish, which from its resemblance to woven damask, the patentee calls "satin damask" finish.

When operating on glossed or glazed paper, or woven fabrics, the patentee em-

ploys a stencil plate, having a design or pattern cut in it, which he places on the surface of the paper or fabric, and then applies a blanket moistened with water, which by coming in contact with the glazed portions of the fabric left uncovered by the stencil plate, removes the gloss therefrom, and produces a dull or deadened pattern, which contrasts strongly with the glazed ground of the fabric. The same effect may be produced by using an engraved block similar to those employed in colour printing, to apply moisture to those portions of the surface of the fabric from which the gloss is required to be removed in order to produce the design or pattern.

When the pattern is to be produced by partially glazing the surface of a fabric, steel plates or rollers are employed, portions of the surface of which have been deadened or rendered dull by dilute acid, stopping out those portions of the surface which are required to be left bright. The fabric to be ornamented is submitted to pressure between the prepared roller or plate and another roller composed of yielding material, by which a design or pattern is produced on the fabric corresponding to that of the deadened portions of the surface of the plate or roller.

Claims.—1. Producing upon the class of fabrics already designated ornamental, designs or patterns, by partially removing the glaze or gloss which such fabrics have received.

2. Partially glazing or glossing paper and other fabrics that are capable of receiving a gloss by pressure, so as to produce thereon ornamental designs or patterns by contrast of the dull and glazed portions of the surfaces of the fabrics so treated.

CHARLES PERLEY, of New York, machinist. *For certain new and useful improvements in the construction of capstans for nautical and general purposes.* Patent dated July 31, 1851.

The object of these improvements is to enable capstans to be worked with greater facility, and in a smaller space than is required when they are set in motion in the ordinary manner; and with this view, the leverage is applied in a downward, instead of in a horizontal direction. The capstan barrel is mounted on a cylinder, which forms the bearings for two short shafts, each of which has a bevel pinion gearing into a ring of teeth formed on the lower part of the capstan barrel; and the ends of these shafts are provided with discs on which are formed eyes to receive the handspikes by which they are turned, and the capstan barrel set in motion. It will thus be perceived that the capstan is made in effect a powerful vertical windlass, and from the power being applied as above mentioned, in a downright direction, and without it being rendered necessary for the men to move round the capstan, as is the case when horizontal levers inserted in the sockets in the capstan-head are employed, the risk of accident to the men at work from the decks being in a slippery state in wet weather, and from other causes, is much diminished.

Claims.—1. The construction and arrangement of the cylinder, hub, and spindle to receive the capstan barrel, with its bevel wheels taking into one or more bevel pinions or shafts, supported and working on the cylinder, and the combination therewith of double-acting pawls.

2. The mode described of constructing the discs with eyes to receive the handspikes.

METROPOLITAN WATER-WORKS.

Errata.

In the following formulæ, for ascertaining the diameters of pipes (p. 76), in the January Part, the figure 5 has been printed instead of the letter S:

$$\sqrt{A} = \sqrt{\frac{3s}{h} - \frac{3a}{4}} - \frac{\sqrt{a}}{2}$$

$$\sqrt{a} = \sqrt{\frac{3s}{h} - \frac{3A}{4}} - \frac{\sqrt{A}}{2}.$$

WEEKLY LIST OF NEW ENGLISH PATENTS.

John Feather, of Keighley, York, worsted-spinner and manufacturer, and Jeremiah Driver, of the same place, iron and brass founder, for certain improvements in screws. February 9; two months.

Auguste Neuberger, of Rue Vivienne, Paris, France, lamp manufacturer, for certain improvements in lamps. February 9; six months.

William Beckett Johnson, of Manchester, Lancaster, manager for Messrs. Ormerod and Son, engineers and ironfounders, for improvements in railways, and in apparatus for generating steam. February 9; six months.

Sanders Trotman, of Clarendon-road, Middlesex, civil engineer, for improvements in fountains. February 9; six months.

John Dennison, of the firm of John Dennison and Son, of Halifax, York, and David Peel, of the same place, manufacturers, for an improved lubricating compound. February 9; six months.

Ralph Errington Ridley, of Hexham, Northumberland, tanner, for improvements in cutting and reaping machines. February 9; six months.

Martyn John Roberts, of Woodbank, Gerrard's-cross, Bucks, Esq., for improvements in galvanic batteries, and in obtaining chemical products therefrom. February 10; six months.

John Smith Hutton, of Bolton-le-Moors, Lancaster, bleacher, and Joseph Musgrave, of the same place, engineer, for a certain improvement or improvements in apparatus used in the bleaching of yarns and goods. February 12; six months.

Christian Schiele, of Oldham, Lancaster, machinist, for certain improvements in obtaining and applying motive power. February 12; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in the heddles or harness of looms for weaving, and in the machinery for producing the same. (being a communication.) February 12; six months.

John Stephens, of Kennington, Surrey, esquire, for improvements in obtaining and applying motive power. February 12; six months.

John Mollady, junior, of Denton, Lancaster, hat-manufacturer, for certain improvements in machinery or apparatus for manufacturing hats or caps. February 12; six months.

Charles Louis Barbe, of Mulhouse, France, for improvements in the reproducing of drawings, and in the mode of obtaining designs, to be principally used in the engraving surfaces for printing fabrics. February 12; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Feb. 5	3109	Westley Richards	Birmingham	Rifle sight.
,,	3110	Frederick York	Augustus-street, Regent's-park.	Box knife, fork, and metal-cleaning machine.
6	3111	John McDougall	Kelso	Cooking apparatus.
,,	3112	Joseph and Thos. Todd.	Cannonmills, Edinburgh	Expanding cap.
7	3113	Edmond Fogden	East Dean, Chichester	Manure distributor.
,,	3114	John Powell	High-street, Eton	Windsor oven.
9	3115	W. and C. Kearthland.	Mill-street, Lambeth	Frame for drying stockings and socks.
10	3116	Jamieson & Kenworthy	Ashton-under-Lyne	Expanding or contracting "wraith," or comb for sizing, warping, and beaming machines.
,,	3117	Kenworthy & Jamieson,	Blackburn, Lancashire	Spiral, expanding and contracting "wraith," or comb for sizing, warping, and beaming machines.
11	3118	A. D. Lamb	Berwick-on-Tweed.	Gas regulator.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

Feb. 5	358	J. G. Wilson, C.E.	Lindsey-house, Chelsea	Tripod castor.
7	359	Ann Hewson	Birmingham	Anti overflow roof-lamp.
,,	360	Henry Redsull	Broad-street, Deal	Life-boat hook.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London— Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburg.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1489.] SATURDAY, FEBRUARY 21, 1852. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

BLUNDELL'S PATENT ROAD-SWEEPING MACHINES.

Fig. 1.

Fig. 2.

BLUNDELL'S PATENT ROAD-SWEEPING MACHINES.

(Patentee Mr. Joseph Birkbeck Blundell, of New Cross-road. Patent dated August 14, 1851. Specification enrolled February 14, 1852.)

Specification.

My improvements in machines for sweeping and cleansing roads and ways are embodied in the machine represented in figs. 1 and 2 of the engravings annexed. Fig. 1 of which is an elevation, and fig. 2 a plan. The distinguishing feature of this improved machine is that, while it is moved forward (which may be done either by horse or manual power) in a right line, it does its work in a diagonal or side-long direction; that is to say, the sweepings are moved towards the sides of the road or way, and there deposited in continuous lines or heaps ready for subsequent removal. AA is the framework of the machine, which is somewhat similar to a cart-body. BB are the two bearing wheels of the machine, each of which is mounted upon a separate axle C. The outer ends of the axles have their bearings in the sides of the body or frame-work A, while the inner ends rest in bearings affixed to the cross-bar D, which occupies a central position within the body or frame-work A. E is a brush, the bristles of which are formed of cane, whale-bone, or other suitable material; it is affixed to the lower edges of the frame A, and placed in a slanting or angular direction in relation to the line in which the bearing wheels of the machine travel, and at such a height that the bristles press with some degree of force upon the surface of the road when the machine is in motion. FF is a brush cylinder which is placed parallel to the fixed brush E, and diagonally across the frame A, from which it is suspended by three sliding bearings G, G, G. These bearings have racks upon their upper ends, the teeth of which gear into three pinions H, H, H, keyed to the shaft I, one only of which pinions is seen in the engravings. K is a handle which, by being turned, actuates the shaft I, and the sliding bearings G, so as to cause the brush cylinder F to press more or less upon the surface of the road, or to raise it entirely up when desired to be thrown out of action. When the machine is drawn forward, the brush cylinder is made to rotate in the contrary direction to that of the bearing wheels of the machine (as indicated by the arrows) by means of the following arrangements. To the ends of the bearing-wheel shafts or axles CC, there are two bevel wheels affixed, which gear into other bevel wheels MM, which last give motion through the spindles NN, and universal joints OO, to two pitch-chain pulleys PP, from which the motion is transmitted by the pitch-chains RR to two pitch-chain pulleys SS, which are keyed to the ends of the axle of the brush cylinder, and cause it to revolve; and this action combines with the operation of the fixed brush E to cause the sweepings to be cast from the right to the left side of the machine, where they are deposited in a continuous line immediately behind the left bearing wheel of the machine. TT are front wheels for the purpose of keeping the brushes travelling in contact with the ground, the axle of which is free to turn upon the centre pin U. Y are the shafts to which the horse is yoked. LL are handles by which the sliding frames carrying the pitch-chain pulleys, PP, can be raised or lowered to adjust the brush cylinder when the bristles are shortened by wear.

From the Hull Advertiser, 13th February.

New Street-Sweeping Machine.—One of Blundell's patent sweeping-machines, manufactured by Mr. Crosskill, of Beverley, was exhibited and tried in the streets of Hull on Tuesday last. Amongst those present at the trial were several gentlemen of the town, including many members of the Board of Health, the Mayor, the ex-Mayor (T. W. Palmer, Esq.), Mr. Huffam (secretary to the Dock Company), J. Oldham, C.E. (surveyor of turnpike-roads), &c., who expressed their approbation at the manner in which the machine did its work. The sweeper consists of revolving brushes, capable of being raised or lowered at will, and working diagonally, beneath a boxed-up kind of cart, inside of which the gear-work is arranged, and is set in motion by the road wheels of the machine. The machine sweeps, most effectually, six feet in width at a time, and collects the dirt or mud for loading into the scavengers' carts, with a rapidity never before attempted, and by a mode perfectly inoffensive to the passer-by. By this machine a whole town may be swept clean before the inhabitants are out of bed in the morning, so that, in foul weather, we may always have

clean streets; and in dusty seasons, by the aid of our waterworks, have every street efficiently watered after the dust has been first swept off by the machine. To make it more complete, a kind of self-cleaning cart is required to follow the machine, and take up the refuse that it deposits. This Mr. Croskill has promised shortly to produce. Now, as roads and streets cost less maintaining by being kept dry and clean, just as our carpets and other household requisites last longer when kept free from dust and dirt, we may hail this invention as another instance of cheap comfort which this prolific age is showering upon society, for the poor as well as the rich alike to enjoy. Kind-hearted people may say that such machines destroy the labour of the poor. But how can this be the case? At present the expense of having a sufficient number of men employed to keep our streets and roads as clean as the machine would keep them, precludes the possibility of so desirable an object being attained. Consequently, we have dirty streets and bad roads, with partial employment of the poor. Whereas, by the constant use of the sweeping-machine, we may have perfectly clean streets and good roads at a price not exceeding the present cost, and, at the same time, give employment to as many persons as are now employed—a great saving being effected in the cost of materials for keeping the streets and roads in good repair.

THE MUSKET AND RIFLE.

Sir,—Will you allow me to make a few remarks on the subject of the musket and rifle. The ball fired from a smooth bore is kept by its weight in closer contact with the lower side of the barrel than with the other side. This makes the ball roll along the barrel, giving it a revolution round its axis at right angles to the line of flight when it leaves the muzzle.

Any projection from the ball is thus presented to the air every few feet, materially increasing the resistance of that medium, and creating a tendency to deviate from the true line. If the ball does not fill the bore, it has a tendency to jump up and down as it passes out, acquiring a motion very unfavourable to a true flight. This is the case in the army musket. All smooth bored guns should be loaded with loose powder, poured in either from a flask or blank-cartridge—a piece of greased flannel or calico laid on the muzzle, the ball placed upon it, and pressed down. The greased patch cleans the barrel, keeps the ball steady, and prevents all windage. With a common double gun thus loaded, I have frequently shot trout lying still or in motion; and one day broke the hind legs of a rabbit at fifty yards, running. The gun was 17 bore, and the bullets were 19.

The rifle, however, is the proper weapon for warfare. The principle of the rifle consists in giving the ball a revolution round its axis coincident with the line of flight. Any inequality in the ball is thus presented to the air in different positions at every part of the revolution. A tendency to deviate to the right is thus met, and counteracted by an equal tendency to deviate to the left at the next half revolution, and thus the ball is kept straight in its flight. This revolution is caused by cutting grooves in the inside of the barrel, winding spirally round it. These grooves cut into the ball, forcing it to follow their inclination, and giving it the required revolution. In a barrel 2½ feet long, the grooves wind a little more than half round, so that the ball makes a full revolution every 4½ feet, or thereabouts. The grooves should be small and sharp, not wide and square. The sharp grooves cut the greased patch and lead like knives, and the ball is pressed home on the powder with ease, and no damage to its shape. The square grooves require much force to be applied to the bullet, which is thus flattened in front. The resistance of the air is much increased in consequence. With a wooden ramrod, best made of lancewood, fitted with a brass knob about seven-eighths of an inch in diameter at one end, and a brass cap at the other, hollowed to fit the surface of the ball, a sharp grooved rifle can be loaded as easily as a sportsman can ram down a punched wad upon the small shot he uses. If the bore is 20 before the rifles are cut, the ball should be 18.

In 1841, I got a sharp-grooved rifle from Messrs. Hollis, 11, Weaman-row, St. Mary's-square, Birmingham. It carried a 19 ball and 19 grains of powder. With that rifle I have hit numbers of trout and eels, both still and in mo-

tion; a salmon in motion; a trout, 10½ inches long, at the distance of 60 yards from the bridge on which I stood; a gentleman's fishing-line, as he was fishing with a worm, at 20 paces; a plumb-line often at 30 paces; a hare, crossing me at speed, at 80 yards; two rats bolting from a ferret, and one swimming across a pond. I mention these shots, to show that a man who only uses the rifle for amusement, can hit small objects; why, then, should not soldiers, whose business it is to hit a mark, be able to use a rifle with precision? The aforesaid rifle I put one day in the hand of a man who had never fired a bullet in his life; and I saw him, at the first shot, kill a magpie 140 yards off. With another sharp-grooved rifle from Messrs. Hollis, carrying a 27 ball and 14 grains of powder, I have done good execution among he trout and salmon. One day I bagged 11 eels in motion out of 14 shots. Another day, at the second shot, I broke the back of a grouse on the ground, at 80 yards; and I grazed another at 120 yards.

With respect to rifle companies, wait not till the machinery of Government is put in motion. Let every gentleman, in his own locality, invite the young men of all classes to assemble once a week for an hour or two. Let him procure a plain, sharp-grooved rifle, and teach the men to load for themselves and fire at a mark. A field, with a high bank to catch the balls, can be met with almost anywhere; or a high wall will do as well. Let them begin at 50 yards, with a black line half an inch wide and four inches long, drawn perpendicularly on a white target, as the mark.

I wrote last week to Mr. Isaac Dugard, 30, Whittall-street, Birmingham, giving him a set price of 7s. for the lock and 8s. for grooving the barrel, and asking him for what sum he could send me a good skelp-barrelled rifle, with a lance-wood ramrod. The answer was, 50s., or even lower, if I liked. One such rifle would serve for twelve men to practise with, each in turn. If need were, the best shot of the twelve might shoulder the rifle, and march to the scene of action. A formidable force might thus be assembled in twelve hours from every part of England. There are plenty of gentlemen who have served some years in the army: they could give the young volunteers useful instruction in skirmishing. Sir Charles Shaw has taken much pains on this subject. I should feel obliged to him if he would inform me of the diameter of the Minié ball, its weight in grains, its length, and whether the grooves in the French rifle are sharp or square. Sir Charles has given a clear account of the stadia; but I doubt if his clever rifle-sight would answer in practice, from the difficulty of putting it on the gun so as to be always in a correct position. I would suggest what is called a rising sight,—a small plate of iron attached to the barrel by a hinge. For such a sight Messrs. Hollis charged me 3s. It had two leaves: one leaf, about four inches long, is enough. Take care to place the hinge square and level on the barrel. When the barrel is bored true, and the outside ground, turn two plugs of iron three inches long (with a small shoulder next the centre point of the lathe), to exactly fill the barrel. Put a plug into each end of the barrel; the shoulders will prevent them slipping in too far; and then put the barrel between the centres of the lathe, fixing it to prevent its turning round. Level the top of the rest parallel to the lathe-bed, and set it to the exact height of the centres. Place it against the barrel, on that side which is to be uppermost when stocked, and with a graver, cut a line about five inches long at the breech, and one about half an inch at the muzzle. These lines will be permanent guides for the adjustment of the sights. When the rising sight at the breech is correctly attached to the barrel, cut a slot in it about 3½ inches long, leaving one-fourth of an inch at top and bottom, and three-eighths of an inch wide: lay the sight down on the barrel, and file the sides of the slot exactly parallel to the line cut on the barrel, and cut a V-nick on its upper edge to exactly correspond with the line on the barrel; then graduate the sides of the slot. To prevent injury to the long sight at the breech, a ferrule may be made to slide over it and the stock, when it is not wanted.

I would conclude with a hint to those gentlemen who are trying the rifle. Use no more powder than the barrel can consume; every extra grain is blown out unburnt, and does no good in propelling the ball. Take care not to hammer upon the ball when it has reached the powder.

A mark made on the ramrod will show when this is the case. By heavily pounding on the ball, the powder is compressed, and the flame from the touch-hole cannot spread rapidly through the grains; much powder is consequently blown out unburnt, and therefore useless. The more care that is taken in giving our soldiers good arms, the better. Every man who buys a gun, tries the lock; if he is not pleased, he gets another. Even a labouring man will not hesitate to give 2*l.* or 3*l.* for a single gun; but an article costing 30*s.*, which requires the strength of two fingers for its discharge, is, it seems, considered good enough for a soldier.

I am, Sir, yours, &c.,

WILES BROWN.

Egglestone, Feb. 9, 1832.

MATHEMATICAL PERIODICALS.

(Continued from p. 135.

XXVII.—*The Mathematical Repository.—Original Papers Continued.*

Theorem.

Every integral number whatever, is either a square or the sum of *two, three,* or *four* squares.

Proposition I.

If A be any prime number, and all the consecutive squares, 1^2, 2^2, 3^2, 4^2, &c. . . . . .

$$\left(\frac{A-1}{2}\right)^2,$$

be divided by A, they will each leave a different positive remainder.

Proposition II.

If A be any prime number, it is always possible to find four squares w^2, x^2, y^2, z^2, such that their sum is divisible by A; that is the equation $w^2+x^2+y^2+z^2=A\,A'$ is always possible.

Proposition III.

The product of a sum of four squares by a sum of four squares, is likewise the sum of four squares.

Proposition IV.

Every prime number is the sum of *two, three,* or *four* squares.

*** In a corollary to this curious and interesting paper Mr. Barlow proves that since,

$$\frac{w^2+x^2+y^2+z^2}{m^2}=\frac{w^2}{m^2}+\frac{x^2}{m^2}+\frac{y^2}{m^2}+\frac{z^2}{m^2},$$

"this curious property (*theorem*) extends, therefore, to every rational number whatever."

Art. XX. Two Letters, containing a demonstration of the Binomial Theorem. By Mr. Thomas Knight.

Art. XXI. A Dynamical Principle. By Mr. Thomas Bazley.

Principle.

If the motion of a body P be any how opposed by the actions of several others connected with it, and the motive forces of these be reduced to the direction of P, and subtracted from its motive force, the remainder is the motive force with which P is urged in consequence of its connection.

*** Mr. Bazley applies his principle to several dynamical questions of considerable difficulty, amongst which is "the curious problem at p. 181 of 'Simpson's Miscellaneous Tracts,'" and "the general problem at p. 285 of 'Mr. Atwood's Treatise on Motion.'"

Art. I., Vol. II., Part III. A Memoir on Elliptic Transcendentals. Containing easy methods of comparing and valuing these Transcendentals, which include elliptic arches, and which frequently occur in the application of the Integral Calculus. By M. A. M. Legendre.

*** This valuable Memoir is concluded in Art. I., Vol. III., Part III., pp. 1—45.

Art. I., Vol. III., Part II. An Essay on Polygonal Numbers. By Mr. John Gough.

Art. II. On the Binomial Theorem and the Logarithmic Series. By Mr. T. Knight.

Art. III. A Proposition to Illustrate the Forty-seventh Proposition of the Second Book of the Principia. By A. B.

Art. IV. Investigation of a curious Indeterminate Problem. By Mr. Cunliffe.

Art. V. Solutions to a Problem in Dynamics.

First solution by a Correspondent—"J. L." (*John Lowry.*)

Second and third solutions by John Bernouilli.

Fourth solution by D'Alembert, taken from his "*Traité de Dynamique.*"

Problem.

Suppose a given weight B to descend by the force of gravity along a given curve CGB, and by means of a string passing over a pulley fixed at C, in the same vertical plane, to draw another given weight A along another curve FAC; required the velocities of the bodies at the points A and B, supposing the motion to commence when they are at the given points F and G.

Art. VI. On the Expansion of the Formula $a\ (A+c\ \cos.\ x)^m$. By Mr. Knight.

Art. VII. On the Sine and Cosine of the Multiple Arc. By Mr. Knight.

Art VIII. Solution to the Problem of making a Magic Square of Nine Cells. By Mr. Noble.

⁂ For a more extended discussion on Magic Squares, see *Ladies' Diaries*, Vol. I., pp. 74—85.

Art. IX. An Experiment that might be made, in order to discover whether or no the Force of Gravity by which Bodies fall towards the Earth in right Lines perpendicular to its Surface, and which, if it were a perfect Sphere, would tend to its Centre, arises from the Mutual Attraction of all the particles of Matter contained in it towards each other, as Sir Isaac Newton supposes. By Francis Maseres, Esq., Cursitor Baron of the Exchequer.

⁂ This experiment is that of swinging pendulums at the bottom of the deep mines in the North of England, and is proposed and illustrated with the usual prolixity of the learned Baron.

Art. X. Remarks on Mr. Gough's Essay on Polygonal Numbers. By Mr. Barlow.

Art. XI. On the Resolution of the Irreducible Case in Cubic Equations. By Mr. P. Barlow.

⁂ In this paper Mr. Barlow enters very fully into the properties of cubic equations in relation to the irreducible case; and a series of very extensive tables for their solution is given at the close of the article.

Art. XII. New Properties of the Conic Sections. By J. F. W. Herschell.

Properties..

1. "If we call a the semiaxis major, e the eccentricity, r the distance between one focus and a point in the curve, R the distance between the other and the same point, u the angle included between r and the line joining the foci; then

$$\frac{R}{r}=\frac{1-2\ e\cos.\ u+e^2}{1-e^2}\text{."}$$

If we now substitute for u " successively

$$\theta;\ \theta+\frac{2\pi}{n};\ \theta+\frac{4\pi}{n};\ldots.\theta+\frac{(n-1)\ 2\pi}{n};$$

and call the corresponding values of

$$r,\ R,\ \left\{\begin{matrix} r\,(1),\ r\,(2),\ r\,(3)\ldots.r\,(n) \\ R(1),R(2),\ R(3)\ldots.R(n)\end{matrix}\right\}\text{."}$$

Then

$$\frac{R\,(1).\ R(2).\ R\,(3)\ldots.\ R\,(n)}{r\,(1).\ r\,(2).\ r\,(3)\ldots.\ r\,(n)}=\frac{1-2\ e^n\ \cos.\ n\,\theta+e^{2n}}{(1-e^2)^n};$$

"which is the general equation" Mr. Herschell "proposed to deduce."

2. When one of the lines drawn from the focus divides the circumference into n parts $\theta=0$, and $\cos.\ n\ \theta=1$,

$$\therefore\frac{R\,(1).\ R\,(2).\ R\,(3)\ldots.R\,(n)}{r\,(1).\ r\,(2).\ r\,(3)\ldots.\ r\,(n)}=\frac{(1-e^n)^2}{(1-e^2)^n};$$

"which, geometrically expressed, will afford a property not inelegant."

3. In the general equation above "let n be odd, and one point of division of the conic section lie in the *nearer* vertex to the focus, the origin of the r; we have

$$\theta=180^\circ=\pi,$$

and

$$\therefore\frac{R\,(1).\ R\,(2).\ R\,(3)\ldots.R\,(n)}{r\,(1).\ r\,(2).\ r\,(3)\ldots.r\ (n)}=\frac{(1+e^n)^2}{(1-e^2)^n};$$

which expresses another general property."

4. The learned author of this paper concludes by remarking, that "it is almost too obvious to require that I should mention that the same equations,

with all the generality of the algebraic signs, apply to the ellipse, hyperbola, and parabola. If we would, however, geometrically neglect the proper signs, we shall have in the hyperbola

$$\frac{\text{R}(1).\ \text{R}(2).\ \text{R}(3)\ldots.\text{R}(n)}{r(1).\ r(2).\ r(3)\ldots.\ r(n)}=\frac{1-2e^n\cos.\theta+e^{2n}}{(e^2-1)^n};$$

and in the other two cases

$$\frac{\text{R}(1).\ \text{R}(2)\ldots.\text{R}(n)}{r(1).\ r(2)\ldots.r(n)}=\frac{(e^n-1)^2}{(e^2-1)^n}\text{ and }\frac{(e^n+1)^2}{(e^2-1)^n}."$$

Art. XIII. Indeterminate Problems. By Mr. James Cunliffe.

Art. XIV. A Method of finding two Arcs of the same Ellipse or Hyperbola, whose Sum or difference shall be a finite Algebraical Expression. (*Fagnani's Theorem.*) By Mr. James Cunliffe.

Art. XV. A New Method of Approximating towards the Roots of Equations of all dimensions. By Mr. P. Barlow.

Method.

"Let

$$x^n+px^{n-1}+qx^{n-2}+rx^{n-3}+\ \&\text{c.}\ w,$$

be any general equation, and let a be an approximate value of x, so that

$$a^n+pa^{n-1}+qa^{n-2}+ra^{n-3}+\&\text{c.}=v;$$

then will

$$a+\frac{(w-v)\ 2a}{(n-1)\ w,\text{ or, }v+(n+1)\ a^n+(n-1)\ pa^{n-1}+(n-3)\ qa^{n-2}+\&\text{c.}}$$

be another approximate value of x (using w or v according as a is integral or decimal." This method is the same as that given by the author in his valuable "Mathematical Tables. London. 1814.")

Art. XVI. Properties of the Right-angled Triangle, and of the Lines drawn and Figures formed in and about the Diagram which accompanies the demonstration of the forty-seventh Proposition of the first Book of Euclid's Elements. By Mr. John Bransby.

*** The title of this paper sufficiently explains the object of its compiler, who, after enumerating the different demonstrations he had met with of the famous 47·1, adds no fewer than fifty-four propositions to those already known to belong to the diagram. Many other collateral properties are also added in the corollaries to the different demonstrations—the whole forming the most complete collection of the properties of the right-angled triangle perhaps extant.

Art. XVII. Mathematical Scraps. By Mr. Thomas White.

First Scrap. A new answer to Question 149, page 42, Vol. II.

Second Scrap. A Solution of a Statical Problem relating to the Equilibrium of a Beam partially sustained by a Weight and Pulley.

Third Scrap. A New Proof of the Proposition at page 2, Vol. II., Part II.

Fourth Scrap. An Explanation of Mr. Atwood's Error in his Solution to Prob. 3, page 131, "Simpson's Miscellaneous Tracts."

Fifth Scrap. "The only Method of showing that the $\sqrt{a}$ may be either $\pm a$, by *actual extraction.*"

Art. I., Vol. III., Part III. Continuation of M. Legendre's Memoir on Elliptic Transcendentals.

Art. II. On Euler's Formula for the length of a Circular Arc. By R. I. Dishneagh.

Art. III. The Cambridge Problems from 1811—1818. T. T. W.

Burnley, Lancashire, Jan. 22, 1852.

(*To be continued.*)

CHIMNEY WIND GUARDS.—COAST DEFENCES.

Note received from J. Mitchell, Esq., by M. S. B.

"In looking over the *Mech. Mag.*, No. 1456, July 5th, 1851, I notice a self-regulating chimney-guard, registered by Mr. James Butcher, of St. James's-place, Bermondsey. I have no doubt but that he supposes the idea to have originated with himself, and it affords me another instance of the vast

number of Sir Samuel Bentham's plans and ideas which have, since his time, been brought forward by other persons as original. This same plan I had communicated to me by Mr. Kingston, in 1809, as one he had from Sir Samuel while he was with him on a survey round the coast.

"When I have used it, it has always been with success; but, to mention one instance in particular: in 1820, when I applied it to ventilate a small portable office, which I occupied some time while I was carrying on the works of Sheerness-yard; and it answering so effectually, Colonel Thomson, R.E., then Commandant of the garrison, adopted it in some of the buildings attached to his dwelling, also to ventilate some of the buildings for the use of the military, viz., the cooking and wash-houses, &c., &c. He also applied it to buildings which were erected for the coast-guard stations in Sheppy. I only mention this on account of Colonel Thomson's being of high standing, sound judgment, and experience.

"However, I would observe that Mr. Butcher has only carried out one-half of the principle; for although that half answers admirably when the wind is direct, or nearly so, yet in cases of low buildings, where the wind comes over high ones, and beats directly down, the principle answers better to have the leaves or flaps *hanging* so as to open at the under part, instead of resting on the under part, and opening at the upper.

"I have found the flaps act more susceptibly by presenting a somewhat hollow or concave surface to the wind, and the inside convex to the vent.

"I am, &c., &c.,

"J. MITCHELL.

"York-place, Pentonville,
"Jan. 16, 1852."

The above note having been received from Mr. Mitchell, it is sent for insertion in the *Mech. Mag.*, on the supposition that it may be deemed a suitable communication.

On inquiry respecting the *portable office*, Mr. Mitchell described it as a structure wholly of wood; it might have been ten feet square, and was exceedingly convenient, as enabling him to have an office at whatever part of the works he had to superintend. When removed, it was taken up bodily by labourers, and carried by them to the required spot. Its construction was such as would have admitted of its being placed upon wheels. The fireplace within it smoked most offensively until the described apparatus was fitted to it—afterwards, never; and the same apparatus was found an effectual ventilator, carrying off foul air, and even steam from a wash-house, as in that of Colonel Thomson's.

The Mr. Kingston mentioned was of Sir Samuel's establishment of mechanical engineers and millwrights at Portsmouth. The survey spoken of was in part to ascertain whether any late improvements in the construction of sea-walls could be made applicable at Sheerness, where the embankment of the dockyard would have to be made on a muddy sandy soil, under deep water. It resulted that nothing that had theretofore been practised could be made available at Sheerness, but by incurring an enormous expense. Sir Samuel therefore devised the mode described in No. 1800 of the *Mechanics' Magazine*.

The other purpose of that survey has since been made the business of a special commission, and is now a much agitated subject—*coast defence*. His own experience in actual naval warfare led to the conviction in his mind that an enemy coming by sea can most certainly be resisted by a *naval* force, and that in *shallow* water large ships are even worse than useless. Viewing matters in this light, he devised various naval measures for our protection against the invasion threatened by Bonaparte—they were partially adopted with acknowledged good effect, and it was with a view to the furtherance of the same mode of defence that the survey in question was made.

With the exception of a few of our principal ports, the whole of our south-eastern, and of our south coast, is only attainable by vessels of a very shallow draught of water; yet there is still a deficiency along that coast of safe and easily accessible harbours for such vessels; consequently those of war, as well as ships of the line, necessarily are forced to resort to distant principal ports both for supplies and for shelter in foul weather; thus a long line of coast is often left entirely without protection; his

object, therefore, was to ascertain the places where harbours of refuge for shallow vessels could be most easily and cheaply made, and where they might be most advantageous in a commercial point of view, as well as conducive to the protection of our shores. He found many places where even as a trading speculation a fair interest might be obtained on the capital to be sunk upon the requisite works.

Unfortunately shallowness of water along so great a part of our coast has been little adverted to in measures taken for its defence. This shallowness is a sure protection against ships drawing much water, but it cannot defend us against those of little draught. In case of war, perhaps, there is less danger than seems to be apprehended that large bodies of troops will effect a landing and destroy our metropolis; but so long as we supinely neglect to provide very shallow, but heavily-armed vessels of war, so long will the peaceful inhabitants on our coasts be exposed to all the miseries attendant on invasion—to the dread of it continually, and to the almost certainty, now that steamers have no fear of contrary winds—that the enemy in single vessels, or in small flotillas, will ravage the country, and take prisoners or slay the few who might attempt to defend their property.

M. S. B.

February 10, 1852.

WHAT BROTHER JONATHAN THINKS OF OUR ENGINEERS' STRIKE.

By the late news from Europe, we learn that no less than 30,000 English operative engineers and machinists, employed in the great engineering establishments in England, have *struck*—that is, they have ceased and refused to work, unless their employers submit to certain resolutions which have been adopted by those mechanics, in society assembled. It seems that they have an accumulated fund of more than 30,000*l.*, and with this, by their usual short-sighted policy, they imagine (or why would they strike?) themselves able to drive their employers into their terms. When we look upon the conflicts of capital and labour in Great Britain—a touch of which we had in this city last year—we are ready to say, "is this all our civilisation has brought us to?" Dreamers may talk about political economy theories as much as they please, and imagine that their lucubrations are ruling the world, while, in fact, not one in twenty thousand pays the least attention to them. It seems to us that neither experience nor anything else can teach the great mass of mankind wisdom. We are opposed to all strikes for wages, and all antagonistic combinations of employers and employees. Every strike yet made has ended disastrously to the workmen, and has proven a dead loss to the country. Every day a man is idle, causes the loss of a day's product to the community. Strikes among workmen are to the body politic what cancers are to the physical system. It is indeed hard for men to toil for low wages; yet we cannot but condemn their conduct in striking; the interests of employers and employed are one; and instead of fighting and wrangling, it would be well for them to cultivate better feelings. In Europe, where, for centuries, there have been continual conflicts between capital and labour—employers and employed—there is too much eye-service—a thing we do detest. The workmen try to do as little as they can, and the employers to pay as little as they can. The one class is just as bad as the other; yea, the workmen have oftentimes exhibited the most outrageous tyranny upon those who were placed under them. The journeymen used to abuse their apprentices; and the cruelties of the cotton-spinners to their "piecers," the calico-printers to their "tearers," are well known. These two trades in Great Britain are ruined to the workmen; the journeymen now make but a few shillings per week; once they made about ten or twelve dollars. They long kept up their prices by means of vitriol and the bullet of the assassin, and at the same time they paid their little "piecers" and "tearers" a bare pittance—scarcely as much as would buy them shoes. Justice and judgment came at last; and these two trades are now among the most miserable in England. May God keep such conflicts out of the United States of America!—*Scientific American.*

MANURE DISTRIBUTOR.

[Registered under the Act for the Protection of Articles of Utility. Edmund Pogden, of East Dean, near Chichester, Agricultural Implement Maker, Proprietor.]

Fig. 2. Fig. 1.

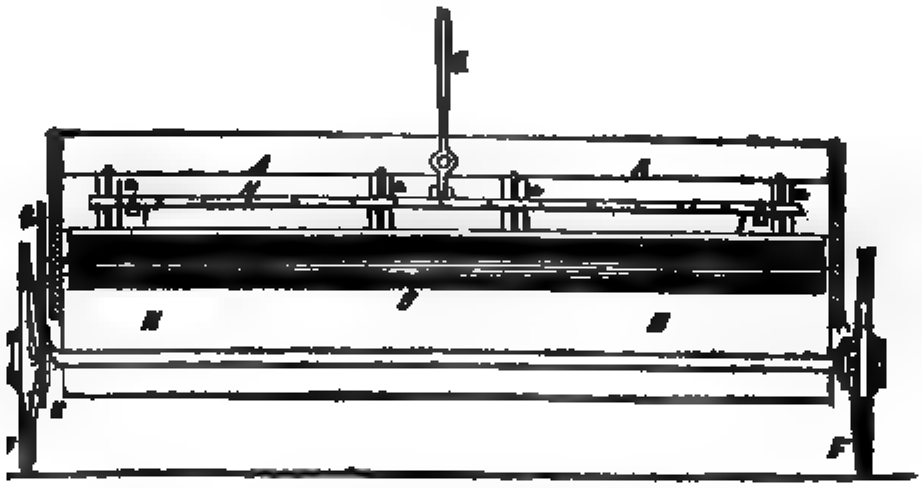
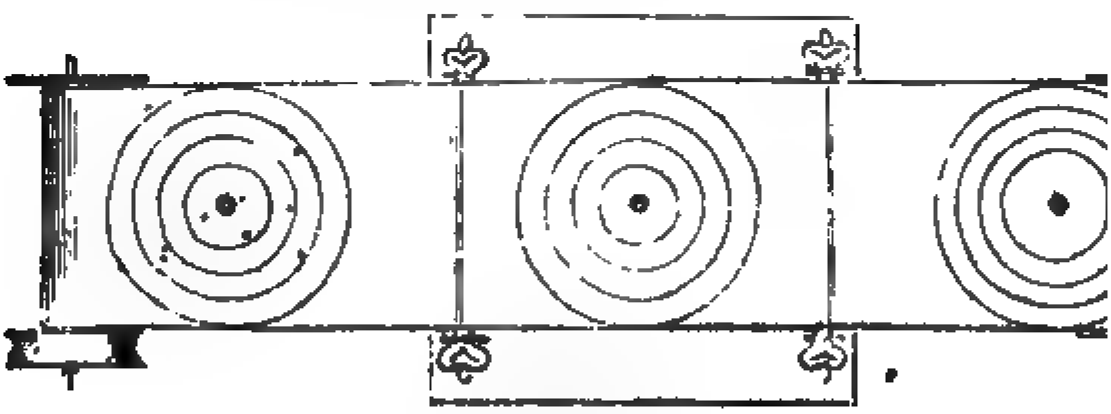


Fig. 1 is a longitudinal section, and fig. 2, a cross section of this machine. A A is a long box or hopper into which the manure in a powdered state is put; B is a fluted roller which occupies a position parallel to a long slot in the bottom of the box; C and D, are two brushes, the bristles of which press against the roller B. The front brush, C, is fixed to the side of the hopper; the other, D, is capable of being slid further up from, or closer down upon the roller, by screws *a a a*, according to the quantity of manure which it may be thought fit to allow to escape; E is a spur which is fixed to the nave of one of the bearing-wheels, FF, and which gears into a wheel G, affixed to the end of the roller B; motion is thus communicated from the bearing wheels to the roller to cause the dispersion of the manure. H is a bar which runs along the centre of the hopper A, in which it is supported by cross-bars JJ; this bar is furnished with a set of projecting arms, and is acted upon by a lever K, so that the attendant may, by moving the lever, prevent the manure from getting clogged, or arched in the hopper. The shafts are attached to the machine at MM. N is a guard-board, to prevent the wind from scattering the manure.

RIFLE TARGET.



Sir,—I send, for the use of Rifle Clubs, a form for a paper target. A continuous sheet of paper, with a number of red circles printed thereon by a paper-hanging manufacturer, is placed on a roller, fixed to the wall and drawn across a stout iron plate, having two iron arms projecting some 10 inches from its face, over which the sheet is placed, and continued on to another roller which is worked by a cord and pulley, so as to bring in succession a fresh target before the plate. The rings enable a comparison of shots to be made without walking the hundred yards

of ground over. The cast plate should be finely corrugated, to prevent the rebound of the ball.

I am, Sir, yours, &c.,
H. D. DENISON.

Upper Fountayne-street, Leeds,
February 2, 1852.

[We have been also favoured by Mr. Denison with an improvement in the Minié rifle ball, but he will see that he has been anticipated in this by the plan of Mr. Murray, inserted in our last Number, p. 114.—ED. M. M.]

CUNNINGHAM AND CARTER'S PATENT METHOD OF PROPELLING CARRIAGES ON RAILWAYS.

A strong effort is making under the auspices of an influential body of subscribers, to recall public attention to the merits of this ingenious system of propulsion, which was fully described in our pages at the time of its first promulgation (see vol. xlvi., page 416.) A large experimental model of a railway on this system may be inspected any Tuesday, at 29, City-road; and the better to enable any of our readers who may avail themselves of the opportunity to understand its peculiarities and to appreciate the advantages which it offers, we subjoin a few extracts from a very able Report recently made upon it by John Chapman, Esq., C.E.

"In working this system it is clear, that if the distance between the successive pairs of air engines be supposed not greater than the length of the shortest train, the question will be reduced to that of the cost of power generated in stationary steam engines and applied to the train by means of the air engines, compared with that of power generated in and applied by locomotive engines, including, of course, interest of any difference in the capital required; for since the train would always be 'in grip,' it could only be a question of the comparative cost of power.

"If, however, the train be shorter than the distance between the successive pairs of air engines, it must rely on the momentum it has when its rear leaves one pair to carry it on until its front reaches the next; and other questions are then introduced connected with the loss of velocity by the train while not 'in grip,' and with the circumstances attending the restoration of its velocity during the action of a pair of air-engines on it.

"Each of these views of the subject is important to its elucidation, and without professing to arrive at conclusions scientifically exact, which would require a line of argument unsuited to the purposes of this report, and for which sufficient authenticated data do not exist, I proceed to show what appear to me to be safe practical conclusions in respect of each of them.

"First, for the sake of definiteness, let us suppose a train to consist of eight carriages, in length about 200 feet; if the air engines were thirty pairs in a mile, or 176 feet asunder, the train would always be in the grip of one pair of engines, and sometimes in that of two. Let it be further supposed that forty trains per day (that is twenty each way) pass over any particular mile. Under these circumstances it cannot require that the air engines be greater than to give the power already found sufficient for such a train when supplied by a locomotive engine.

"Mr. R. Stephenson says that the engine itself absorbs about as much power as fifteen loaded carriages; and other published statements afford no more favourable view of this point of locomotive practice. If a locomotive with two cylinders of 15 inches diameter, 22 inches stroke, 5 feet driving wheels, and an effective pressure of steam of 50 lbs. to the inch, is capable of managing fifteen carriages (and probably several more), an easy computation shows that as much power as eight carriages now receive from the locomotive would be derived from a pair of air engines with pistons 20 inches in diameter, a stroke of 24 inches, driving wheels of 5 feet, and an effective atmospheric pressure of 7 lbs. per squre inch. Whether this is the most advantageous pressure to be employed is a point not here investigated; it is assumed for the mere purpose of illustration.

"That air engines of this size would in fact be much more than large enough for the purpose is shown by the following deduction. Mr. Wyndham Harding's rule for the resistance of railway carriages on a level line, gives for that of the train a supposed pressure of 855 lbs.; and this, at a velocity of thirty miles per hour, or, 2,640 feet per minute, amounts to a momentum per minute in feet and lbs. of 2,257,200; while that of the air engines of the size above mentioned, and working at the same speed, is 2,956,800; giving an excess of nearly one-third over that required by the rule above mentioned.

"In fact cylinders of 17½ inches diameter instead of 20 would fulfil the conditions of Mr. Harding's rule; and to this effect of the cylinders, which we thus see to be too large, we have to add in the case supposed the fact that for 24 feet in each space of 176 passed over, this train of eight carriages would be in the grip of two pairs of engines,

and so receive one-seventh more power still. The effect of the whole is to provide in the proportions proposed for the air engines 50 per cent. more power than any evidence shows that such a train is likely to require, and if they be sufficient, or more, for such a train they cannot require to be greater for any other which is supposed to be always in grip; for a longer train is either in grip of more pairs of engines than one, or at least is operated on for longer time by the one which does apply to it.

"Although air cylinders of the size mentioned are thus shown to be considerably larger than the work will require, I will assume these dimensions for them as the basis of the further requisite calculations, in order to avoid danger of error from suppositions too favourable to a yet untried invention. It will, however, be necessary to point out in the right place, a seeming anomaly to which this safe but somewhat excessive allowance leads hereafter.

"These air engines are however only the agents through which the power generated in the stationary engines is applied to the carriages. It is now necessary to see what power will be requisite in the stationary engines themselves. We have agreed above to admit for the present that the work requires thirty pairs of air engines per mile, whose cylinders are of 20 inches diameter, with 24 inch stroke, and 5 feet driving wheels, the effective pressure being 7 lbs. per square inch. These will discharge into the main pipe 5,867 cubic feet of air per mile for every train which passes them, or for forty trains per day 234,666 cubic feet of air per mile. This air will expand in the pipe to the rarity of that in the pipe as maintained by the exhausting action of the stationary engines: and the power required to be exerted by the stationary engines is really that required to re-compress this air to atmospheric density.

"To ascertain the amount of this power, let us first make an allowance of 1 lb. per square inch on the pistons for the friction, clearances, leakage, and other incidental causes of loss of power at the air engines and carriages; we then require a difference of pressure between the atmospheric and the rarefied air in the pipe of 8 lbs.; that is, the air in the pipe must have a pressure of 7 lbs. per inch. Now 234,666 cubic feet of air, of atmospheric density, admitted into a pipe where the air is of only 7 lbs. pressure, will expand into 502,856 cubic feet; and the power required for the re-compression of this air, if exerted during twenty-four hours, may be shown by a well-known mode of computation, to be 8½ horse power per mile for forty trains per day of eight carriages per train. But this operation is accompanied with some sources of loss of power, which are principally leakage, he friction of the air in passing along the main pipe, and the power required for the expulsion of the recompressed air into the atmosphere. On the plan of this invention, these occasions of loss of power need not be very considerable, and an addition of 50 per cent. to the power already calculated for appears to be ample for meeting them. This raises the total power required in the stationary engines to 12 horses per mile, supposing it to be so managed as that it could be worked equally and incessantly during the whole twenty-four hours; but if its action is confined to intervals, amounting to twelve hours a day, the power to be provided would be doubled or would be raised to 24 horse power per mile. If this power were grouped in engines at about 10 miles asunder, as proposed by the patentees (which may or may not be the most eligible distance according to circumstances), the power required in each set of stationary engines would be that of 240 horses.

"This, indeed, is not the proposal of the patentees, nor is it the mode in which the invention is intended to be worked; but I have discussed it in the first instance for the sake of an important practical inference, which the following estimate affords:—

"CAPITAL.

	£	s.	d.	£	s.	d.
"Stationary Engines, at 240 horse power, per 10 miles, with Air Pumps, &c., complete, per mile	840	0	0			
"Air Engines, 30 pairs, per mile, at 150*l.* per pair	4,500	0	0			
"Main Pipe, say as large as 20 inches diameter, at 15*s.* per yard	1,320	0	0			
"Total cost per mile of Works peculiar to this system				6,660	0	0
"Deduct 40 lbs. per yard from the Rails, through avoiding the uses of Locomotives, 125 tons, at 6*l.* per ton				750	0	0
				£5,910	0	0

	£	s.	d.
"Deduct the cost of Locomotives, and Works special to the Locomotive system	2,000	0	0
"Excess of Capital per mile, for Works on the system (mechanically) of Messrs. Carter and Cunningham, but not worked in the manner proposed by them	3,910	0	0

"The interest of this sum divided amongst forty trains per day, for 365 days in the year, amounts to 3·2 pence per train per mile.

"CURRENT WORKING.

	Per Mile per Day. s.	d.
"Coals for stationary Engines, 24 horse power, per mile, worked 12 hours per day, with 5 lbs. of coal per horse power per hour, at 10s. per ton	6	5
"One Engineman, two Stokers, and two Cleaners, at each stationary Engine, 19s. per day, for ten miles	1	11
"One Man per mile to attend to the Air Engines	3	0
"Oil, Tallow, &c.	4	0
"Repairs, estimated by comparison with Locomotive and other machinery, 1d. per mile per Train	3	4
"Cost of working (as above) per mile per day	18	8

"This cost, divided among forty trains, gives 5·6 pence for the cost per mile per train.

"Putting together these two sums, it appears that the interest on the excess of capital required by this system in the case (not intended for practice) which I supposed, together with the current cost of working, would amount to (3·2 + 5·6 =) 8·8 pence per train per mile; while the cost of working locomotive engines is admitted to average at least 10d. per mile. The inference then to which I wish to draw attention is this,—that supposing that peculiarity of the system to fail respecting which doubts may most naturally be entertained by those who do not investigate the subject, and supposing therefore the necessity to arise after trial of placing the works on a footing so elaborate and expensive as to render it as nearly as possible similar in action to the locomotive system, even then a line of moderately large traffic could not be injured by the adoption of the plan, since it might work its traffic so much more cheaply on this plan as to pay interest on all the extra capital required, and save as much besides as would pay for maintenance of way. This supposition, however, gives up (for the sake of illustration), in fact, one principal feature of the system. I proceed therefore to consider it as proposed for practice by the patentees.

"The plan proposed is to take out every alternate pair of air engines, and let the train depend on the momentum with which it leaves one pair of air engines to carry it on to the other; and since this proposal affects very materially the commercial results of the invention, while on the other hand it introduces a new practice into the management of railway trains, it is of importance that the principles on which it depends should be carefully ascertained and applied. It is clear that while remaining free, that is, not 'in grip,' the train will lose velocity, and the next pair of engines it reaches must be capable of restoring the velocity with which it left the last, besides overcoming the resistance due to the train during the time of its passage through that pair of engines. Taking the same train as before, I have agreed to consider air cylinders of 20 inches diameter and other particulars as above, as sufficient to work that train by means of continuous action upon it, believing them however to be much too large. But if we take out every alternate pair of engines, so as to leave 15 in the mile, 352 feet asunder, the train above supposed, of 200 feet long, will travel 152 feet 'free' between leaving one pair of engines and reaching the next. What addition must be made to the diameter of the cylinders to enable the air engines to restore the velocity thus lost?

"In answering this question, I dispense, for the sake of simplicity, with the more elaborate investigations which rigid scientific accuracy would require; choosing, where choice is necessary, the terms and figures furthest from leading to deceptively favourable result. I take, again, Mr. Wyndham Harding's formula for the resistance of railway trains, and I apply it to the case by means of the simple principle, that the loss of velocity in a given time is proportioned to the resistance, neglecting however in short distances the effect of the diminution of the resistance as the velocity decreases. The following Table, calculated on this principle, will explain itself:—

VELOCITY.		Retarding Force per Ton. of the Weight of the Train.	Loss of Velocity per Second in a Second.	Loss of Velocity per Second in travelling over 100 feet.
Feet per Second.	Miles per Hour.	lbs.	Feet.	Feet.
66	45	27·75	0·398	5·603
58⅔	40	24·66	0·350	0·603
51⅓	35	21·74	0·313	0·609
44	30	19·00	0·273	0·620
36⅔	25	16·41	0·236	0·643
29⅓	20	14·00	0·201	0·685
22	15	11·75	0·169	0·767

"From the last column of this Table, it appears that a train running 'free' at 30 miles an hour, or 44 feet per second, is losing velocity at the rate of 0·620 feet per second in running over 100 feet—that is, at the end of 100 feet, its velocity will be 0·620 per second less, and consequently it will be 44 feet diminished by 0·620 per second, or 43·380 feet per second. At 25 miles per hour the loss is 0·643 feet per second. Neither of these numbers is perfectly accurate for a velocity varying between 30 and 25 miles an hour; but taking the highest as least favourable to the present argument, it follows that a train which left one pair of air engines with a velocity of 30 miles an hour, would enter the next, after running free over 152 feet, with a velocity diminished by ($0·643 \times 1·52 =$) 0·977 feet per second, or two-thirds of a mile an hour.

"Since the train is taken at 200 feet long, and as moving at nearly 44 feet per second, the duration of the action of the next air engines on it will be about 4½ seconds. The momentum to be restored in that time is that of 45 tons at 0·977 feet per second, which requires a force of 580 lbs. at the circumference of the traction-wheels, which increased in the ratio of the velocity of the pistons to that of the train, and supposing the pressure to be 7 lbs. on the inch, requires an additional surface of 382 square inches in the two cylinders of each pair of air engines—that is, that the cylinders should be increased in diameter to 25½ inches instead of 20 inches, as before. The discharge of air into the main pipe instead of being that of two 20 inch cylinders will be that of one of 25½ inches, or will be diminished in the ratio of 800 to 543, which is also the ratio of the power employed in the two cases, or instead of 24 horse power per mile there would be required on this plan only 19.

"No doubt, to do the same work over the same distance, the same power is theoretically requisite in whatever form it may be employed; yet here the power for the same work appears to be greatly diminished; and this is the apparent anomaly which I mentioned before. It arises from the fact, that the measure of the cylinders, deduced from from a wide interpretation of Mr. R. Stephenson's statement, is much too large. If that deduced from Mr. Wyndham Harding's rule had been adherred to—viz., 17½ inches diameter, and due allowance made for the distance run free; it would have been that the system makes no profession of overleaping a law of nature. I retain, however, the larger figure for the sake of using, in this discussion, a statement made on the highest locomotive authority, and applied with a liberality to which nothing can be objected. But then I ought also to remark, that if cylinders of 17½ inches are taken as a basis, with 191 additional square inches for the restoration of velocity, the cylinders really required, would be only of the diameter of 23½ inches, and the power required about two-thirds of our first calculation, or 16 horse power per mile.

"I am aware that even this exceeds the estimate of the patentees; the difference arises from that of our modes of investigation; theirs is based on observations which, if not very definite, I am inclined to think, from a variety of circumstances, will be borne out in practice; mine adopts the statements of some of the authorities most justly relied on in locomotive practice, and applies them to this case by means of undoubted mechanical principles.

"Still adherring to the rule of taking the least favourable result, I proceed to frame, on the basis of 19 horse power per mile an estimate first for capital and then for working costs. . . . .

"The total, therefore, of interest on extra capital and of working cost is ($0·78 + 4·3 =$) 5·08, say 5*d.* per train, per mile, that of the locomotive system for the same service being 10*d.* I need not point out the importance of this result, which, I believe, practice will fully confirm.

. . . .

If there be any circumstance in the action of this machinery which is likely to raise a doubt in the mind of a mechanist, it is the sudden impact of the traction rails of the carriages on the wheels of the air engines. But this action can hardly occasion injury; for the wheels, not being fly-wheels, need be of no greater weight than is required by strength to bear the necessary pressure for traction; their weight consequently will be small in comparison with that of the train, and they will therefore offer little resistance. The other parts of the air engines suffer no more, probably much less, than the similar parts of locomotive engines, which are brought to rest and regain their highest speed twice in every revolution of the driving wheels.

I do not therefore anticipate any difficulty from the character and details of the machinery but such as actual use always discovers and remedies; and I may add that the longitudinal valve, at once a great novelty, an indispensable part, and the greatest difficulty of the atmospheric system, as formerly attempted, is in this replaced by parts well known, and perfectly easy to be maintained in a state of efficiency at small expense.

It may be right here to add that although this, like some former systems, employs the pressure of the atmosphere to propel railway carriages, its differences from those systems are so great, *that no inference adverse to this can be drawn from any failure of theirs.* The avoidance of the longitudinal valve and of the limitation of the action of each of the stationary steam engines to one local division of the line, and to the time of the passage of a train, are sufficient to show how necessary it is to judge of this system on independent grounds.

. . . .

On reviewing the whole subject, I feel that I can fairly come to no other conclusion than one very favourable to the invention. The three cases I have particularly examined, seem to me to form the limits within which most or all other cases will practically fall. In examining them, I have used data supplied by authorities of the highest character (advocates of another system) before this invention, I believe, was in existence, and who could not possibly be influenced in its favour. I have applied those data by means of the most unquestionable principles of mechanical science. My original impressions, which were somewhat adverse to the design, have been changed by the inquiry; and I can see nothing in the nature of the means to be employed to neutralise the great advantanges I think to be demonstrably derived from the essential principles of the invention. Under these circumstances, I cannot but rely on the conclusions I have drawn, as likely rather to fall short of, than exceed, the success which, under actual experience, the system is likely to achieve; and I expect its introduction largely to increase public convenience, and to produce highly satisfactory profits to those who may promote or employ it."

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING FEBRUARY 19, 1852.

EDWARD DE MORNAY, of Mark-lane, gentleman. *For improvements in machinery for crushing sugar canes, and in apparatus for evaporating saccharine fluids.* Patent dated August 5, 1851.

The "improvements in machinery for crushing sugar canes," consist in certain new arrangements of roller-mills, which the patentee calls "single acting" and "double-acting" mills. In the "single acting" mill, the feed-roller of the ordinary three-roller mill is replaced by one of a smaller diameter than the crushing rollers, or two or more such small feed-rollers are employed, by which means the trash-returner is enabled to be altogether dispensed with, and the crushed cane is delivered from between the rollers in such manner that there is less liability than usual of its absorbing any of the expressed juice. In the "double acting" mill two sets of crushing rollers are employed having a trash-returner to direct the cane between the second pair of rollers after it has passed through the first pair. A feed-roller of small diameter, or two or more such small feed rollers, are also employed with this arrangement of roller mill.

Under this branch of his invention, the patentee also specifies some improvements on the cane press, patented by Mr. H. Bessemer, in April, 1849. The improvements consist in making the sides of the perforated tube, in which the canes are compressed, to diverge gradually from the feed-end to about the middle of its length, from which point to the discharge end, the sides may be either parallel to each other or converge, as may be found in practice most desirable. Mr. de Mornay proposes also in feeding the machine, to supply the canes in layers, alternately in opposite directions, by which the strain on the sides of the tube is more equally distributed.

The "improvements in apparatus for evaporating" consist in forming evaporating pans with transverse partitions capable of sliding in the pans from end to end, so that while the evaporated juice is being discharged at one end of the pan, a fresh supply may be introduced at the opposite end of

the pan. Instead of one such partition, two or more may be applied. A second improvement consists in the introduction into evaporating pans of wires laid transversely across the pan, near the bottom, for the purpose of dividing the juice in its flow, and bringing it into contact with atmospheric air to enable the process of evaporating to be conducted at a low temperature.

Claims 1.—In respect of the "single-acting" roller mill, the introduction of a feed-roller of less diameter than the expressing roller, and the introduction of several feed-rollers.

2. In respect of the "double acting" roller mill, the introduction of one or more feed rollers, the one placed nearest the expressing rollers being of less diameter than the said expressing rollers, in conjunction with two pairs of expressing rollers, so placed that the canes receive two squeezes as they pass through the mill, and in such manner that at each operation the juice is forced out in a downward direction, and the pressed canes ascend as the rollers revolve and leave the juice, and consequently do not, as at the first squeeze in the common three-roller mill, again come in contact with the flowing juice.

LEVI BISSELL, of New York, engineer. *For certain new and useful improvements in the means of sustaining travelling carriages and other vehicles, which improvements are applicable to other like purposes.* Patent dated August 5, 1851.

Mr. Bissell's springs are constructed of wood, of a suitable tapering form, having a series of transverse saw-cuts on the under or convex side, in which are inserted pieces of metal, wood, or yielding material, according to the nature of the uses to which the springs are to be applied. In some cases, a metal plate is attached to the concave side of the spring, and bolts are passed through the wooden portions between the saw-cuts, for the purpose of holding the wood and metal together; or a plate of metal, with transverse ribs, may be employed, having blocks of wood inserted endwise between the ribs, and secured to the metal plate by bolts and nuts. These springs are adapted for all the uses to which ordinary metallic springs may be applied, and two of them may be combined to form elliptical springs (in which they will be hinged together at both ends), or they may be applied in the same manner as the body springs of carriages.

Claim.—The construction of springs for sustaining pressure, either of wood alone, or of wood and metal, or other elastic or non-elastic substance or substances, combined as described.

EDWIN DEELEY and RICHARD MOUNTFORD DEELEY, of the Dials Glass-house, Stourbridge, flint and bottle-glass manufacturers. *For certain improvements in the construction of furnaces for the manufacture of glass.* Patent dated August 6, 1851.

These improvements consist in arranging the fire bars of glass furnaces in an inclined position, so that the flame and products of combustion arising therefrom may play directly against the sides of the melting-pots. The bed of the furnace is at a higher level than the lowest part of the fire-bars, and it is bevelled off at the back of the bars so that the flame may meet with no obstruction in rising against the melting-pots. The patentees do not confine themselves to any particular angle of inclination for the fire-bars, but they recommend some incline between 35° and 55° as being well-suited for the purpose.

Claim.—The construction of furnaces for the manufacture of glass with grates having inclined bars or perforated plates situate and arranged so that the flame may play directly on the pots.

ROBERT HYDE GREG, of Manchester, manufacturer and merchant, and DAVID BOWLAS, of Reddish, manufacturer. *For certain improvements in machinery or apparatus for manufacturing weavers' healds or harness.* Patent dated August 7, 1851.

These improvements are embodied in certain mechanical arrangements for manufacturing weavers' healds or harness employed for supporting and separating the warp threads in looms, by machinery instead of by hand as is ordinarily practised. The apparatus consists mainly of a frame for carrying the heald shafts, four travelling shuttle boxes, and two shuttles, containing the cord or twine of which the healds are formed, an arrangement of bobbins for carrying the pitch band or binding threads, and a gauge-rod and fingers for determining the length of loop in the heald, and tying the knots, the whole being combined with suitable arrangements for actuating the several parts, so as to hold the threads of which the healds are formed, while the knots are tied and the loops are formed by the action of the fingers and shuttles.

Claim.— The peculiar arrangement or combination of machinery described for manufacturing weavers' healds or harness, or any mere modifications of the same which may be made to accomplish such or similar purposes in contradistinction to performing the same by hand, and especially the use or employment of shuttles and fingers for tying the knots of the healds by mechanical means.

ALPHONSE RENE LE MIRE DE NOR-

MANDY, of Judd-street, gentleman, and RICHARD FELL, of the City-road, engineer. *For improved methods of obtaining fresh water from salt water, and of concentrating sulphuric acid.* Patent dated August 7, 1851.

The apparatus for freshening salt water consists of a vertical cylinder having a series of horizontal partitions communicating each with the one below it, and each with a pipe leading to a condenser. A space is left between the sides of the cylinder and the partitions, to allow of steam circulating freely within the interior of the cylinder. The salt water to be freshened is introduced into the apparatus from the top, and circulates over the partitions, and the aqueous vapour arising from it passes off to the condenser, and on its way becomes mixed with atmospheric air introduced through a suitable pipe, and issues from the condenser in an aërated state, while the water arising from the condensation of the steam admitted into the cylinder is discharged therefrom without being aërated. The apparatus may be constructed of any suitable materials, but the patentees recommend the use of zinced or galvanized iron.

For "concentrating sulphuric acid," the apparatus consists of a horizontal cylinder or envelope, surrounded by a furnace, and having a set of longitudinal partitions, by which it is divided into compartments, each of which communicates with the one above and below it. Each of these partitions is turned up at one end, so as to direct the acid flowing on to it from the partition above towards the opposite end, whence it flows over to the partition below it, and traversing each successively (the apparatus being meanwhile maintained in a heated state), is concentrated thereby, by evaporation and distillation, and delivered from the apparatus at the lower part. The water vaporized by the heat of the furnace, passes off through a suitable aperture in the upper part of the cylinder or envelope. The cylinder itself is lined, and the partitions are covered with leaf platinum, or the partitions may be composed of glass, porcelain, or some other material not affected by sulphuric acid.

Claims.—1. The above-described method of procuring fresh water from salt water, of whatever materials the apparatus may be composed, or however the different parts thereof may be placed with reference to one another, so long as the same effect is produced substantially in the same manner.

2. An apparatus in which sulphuric acid is made to flow upon slabs unattackable by that acid, placed within an envelope, which may be, like platinum, unattackable by sulphuric acid, and whereby the acid in question is concentrated by evaporation and distillation, as above described.

LOCKINGTON ST. LAWRENCE BUNN, of Walbrook, merchant. *For improvements in the manufacture of kamptulicon.* Patent dated August 7, 1851.

The *first* of these improvements consists in rendering sheets of kamptulicon more durable and less liable to be affected by atmospheric influences by the application of sheets of loosely woven fabrics, wire gauze or perforated metal, which may be attached to one side only of the same, or enclosed between two sheets or layers. The compound sheet thus formed may be ornamented by printing on the kamptulicon surface, or on the exterior of the woven fabric applied to one side of a sheet of kamptulicon.

The *second* improvement consists in producing coloured sheets, blocks, or layers of kamptulicon by applying to the surfaces of ordinary sheets or blocks a layer of kamptulicon which has been coloured by the introduction into it in the course of manufacture of suitable pigments, or by staining the cork dust or shavings employed previous to mixing them in the masticating machine with the caoutchouc employed in such manufacture.

The *third* improvement consists in manufacturing kamptulicon pavements in mosaic and other similar patterns. For this purpose the patentee takes a number of strips of coloured kamptulicon, which he unites together so as to form a solid block, arranging the strips in the block according to any required design or pattern of mosaic work. He then cuts off from this block thin sheets, which are applied in the manner of veneers to pavements or other purposes for which the same may be applicable.

Claims. — 1. The application of woven fabrics, wire gauze, perforated metals, or other similar materials, between two layers or sheets of kamptulicon, and printing or ornamenting, the same as described.

2. The manufacture of sheets, blocks, or layers of kamptulicon combined with pigments or other colouring matters, or to other kamptulicon in an uncoloured state.

3. The manufacture of kamptulicon into mosaic or other patterns, either for pavements or other purposes.

JONATHAN GRINDROD, of Birkenhead, Chester, consulting engineer. *For an improvement in the machinery for communicating motion from steam engines or other motive power, and in the construction of rudders for vessels.* Patent dated August 14, 1851.

Claims. — 1. An improved arrangement for communicating an increased speed from

the engine to the propeller shaft of screw and paddlewheel-propelled vessels, in so far as respects the combination of the sun and planet motion (the parts thereof being newly arranged) with the cranks, bearing strap, and guide rod described.

2. Several modifications of the arrangements first claimed, when applied to locomotive engines and other machinery.

3. The employment of two rudders placed alongside of the sternpost of a vessel, and fitted in a peculiar manner described.

STEPHEN MOULTON, of Bradford, Wilts, India-rubber manufacturer. *For certain improvements in the preparation of gutta percha and caoutchouc, and in the application thereof.* Patent dated August 14, 1851.

It is well known to persons acquainted with native gutta percha, that this gum is extremely liable to be affected by changes of temperature, that it becomes rigid under a low, and soft under a moderately high temperature, and, moreover, that it is almost destitute of elasticity. These disadvantages prevent its application to many useful purposes for which it is otherwise adapted. Now the patentee obviates these disadvantages by combining with the native gutta percha, either alone or mixed with a certain proportion of caoutchouc, a mixture of hyposulphite or sulphite of lead or zinc with artificial sulphuret of lead or zinc, and submitting the same to the action of a high degree of temperature, thereby produces a new compound, which he calls cured gutta percha, and which remains unaffected by change of temperature, possesses a considerable amount of elasticity, and resists the action of solvents of the gum in its native state.

The process adopted in the treatment of gutta percha is as follows:—The patentee takes one pound thereof, or as much more as can be conveniently ground or worked, and having cleansed it from impurities, he adds to the same from two ounces to half a pound of hyposulphite of lead or zinc and artificial sulphuret of lead or zinc, in about equal proportions of each, with from two to twelve ounces of Paris white or chalk, in a powdered state. These ingredients are then mixed together, and ground between heated rollers, and otherwise treated in the manner directed in the specification of a patent granted to Mr. Moulton, Feb. 8th, 1847.

When the gutta percha is combined with caoutchouc (which may be done in equal proportions, or in any other desired proportions), the process is conducted in the same manner; the quantity of hyposulphite of lead or zinc and artificial sulphuret of lead employed in this case, is from two to six ounces, and of Paris white or powdered chalk, two to twelve ounces for every pound of gutta percha and caoutchouc mixture. This composition possesses more elasticity than the cured gutta percha, but is not so well calculated to resist the action of oils.

To produce a hard cured gutta percha or gutta percha and caoutchouc composition, the patentee adds to every pound thereof from two to twelve ounces of calcined magnesia, but conducts the process, in other respects, exactly as if the magnesia had not been used.

The compositions above mentioned having been manufactured into sheets or moulded articles, are finally submitted to the action of steam or dry heat of from 250° to 350° Fahr. in a closed room or vessel. The time occupied in this curing process varies from two to ten hours according to the size and thickness of the articles treated.

Claims.—1. The use in combination with gutta percha alone, or with gutta percha and caoutchouc, of the acids of sulphur of a lower degree of oxygenation than sulphuric acid in combination with suitable bases, but the use by preference of a hyposulphite, which can be used alone or in combination with the salts of the acids of sulphur, or with the sulphurets.

2. The use of the artificial sulphurets of lead or zinc in combination with Paris white or chalk, used with the gutta percha alone, or gutta percha and caoutchouc, or with a salt of a lower degree of oxygenation than a sulphate and artificial sulphuret of lead or zinc.

3. The treating of gutta percha either alone or with caoutchouc by combining therewith calcined magnesia, or carbonate of magnesia and hyposulphite of lead or zinc, and the artificial sulphuret of lead or zinc, and subjecting it to a high degree of temperature.

JOHN PLANT, of Beswick, manufacturer. *For certain improvements in the manufacture of textile fabrics.* Patent dated August 14, 1851.

Claim.—The employment in the manufacture of the fabrics known as "cut cords" of two or more shuttles, so regulated in their order of throwing the weft, as to produce when cut and raised, a coloured stripe or stripes upon the cords in the direction of their length, whether such stripes extend continuously over the piece of goods, or are interspersed with other patterns.

THOMAS SKINNER, of Sheffield. *For improvements in producing ornamental surfaces on metal and other materials.* Patent dated August 14, 1851.

The "improvements in ornamenting metals" consist in combining for this purpose

the processes of transferring designs from suitable plates and electro-plating, or electro-gilding.

A design or pattern having been drawn on a copper plate, an impression from it is transferred to the metal to be ornamented, and the surface left uncovered is then stopped out with a varnish composed of gum guaiacum dissolved in spirits of wine. As soon as the varnish is dry, the ink impression is removed by rubbing it with a sponge dipped in turpentine, after which dilute acid is applied to eat away the portions of the plate formerly covered with the design. The plate is then submitted to the process of electro-plating or electro-gilding, and the ornamentation thereby completed. Or, in the case of Britannia metal and German silver, a pattern may be transferred, and then sunk by acid, as above described, without resorting to the process of electro-plating. If it should be desired to produce a pattern in relief, the mode of operating above mentioned is reversed, and the parts of the metal on which the design is printed are protected from the action of the acid employed to reduce the unprinted portions of the plate, by sprinkling resin in a powdered state over the impression, and then melting it by the application of gentle heat. The raised portions of the plate are subsequently electro-plated or electro-gilded by the processes ordinarily adopted for that purpose.

The "other materials" alluded to are bone and ivory, which the patentee ornaments by transferring designs on to their surfaces; and when the portions of the plate required to be left plain have been covered with gum or varnish, the bone or ivory is submitted to the action of dilute acid, to open the pores of the material, and the permanent pattern is then produced by a suitable dye or composition; or the dye may be applied without the previous use of dilute acid.

Claims.—1. The means described of producing ornamental surfaces on metal.

2. The means described of producing ornamental surfaces on bone and ivory.

RECENT AMERICAN PATENTS.

(From the *Franklin Journal.*)

For an Improvement in Moulding and Casting Stereotype Plates. *Charles Hobbs.*

The nature of my invention consists in moulding and casting any given number of stereotype plates at one operation; besides making them more rapidly than can be made by any other known method, it makes them more perfect.

Claim.—What I claim as my invention is, 1st. The moulding, in plaster, of one or more forms of type, wood-cuts, medals, &c., at one operation, in air-tight vessels, by means of exhaustion.

2nd. I claim the making of the plaster moulds with two faces.

3rd. I also claim the casting from one or more moulds, in a box sufficiently tight to hold fluid metal, and bringing the face perfect by means of the weight of fluid metal confined above them in column, or otherwise.

4th. I also claim the grooved wedges for retaining the moulds in their places while casting from them.

5th. I also claim the non-admission of fluid metal to the moulds until the orifice through which it enters is sunk beneath the surface of the fluid metal, thus preventing the dirt and dross from entering with it.

For an Improvement in Mercury Baths for Photographic Purposes. *John Moulson.*

The nature of my invention consists in the agitation of the mercury or other substances used immediately previous to the exposure of the photograph impression to its influence, and upon a cooler surface than that of the mercury cup proper, which I generally expose to constant heat, throwing off the said heated surface of the cup, the mercury or other substance, when not intended for use, thereby to cool it and to agitate it, and to prevent its evaporation, or vaporization when not in use; all of which I am enabled to do by means of my "moving lever-cup bath for photographic purposes," with or without my double plate-holding slide.

Claim.—What I claim as my invention is my moving and moveable lever cup, or its equivalent, and bath, for photographic and daguerreotype purposes.

I claim the agitation of the mercury upon a cooler surface immediately previous to its use in the heated cup (or part of it), for the development of photographic impressions, by means of my moveable lever cup, or its equivalent.

I claim the lever cup, or elongated cup, moveable perpendicularly on an axis or centre of motion, which centre of motion need not be confined to a particular part of the cup, but it may be varied and placed in any manner giving and admitting the movement of the cup, but must be so arranged as that the mercury, or other substance, may flow from the heated surface of the cup to the cooler surface of the tube or elongated cup, and *vice versâ*, by elevating or depressing the exterior end of said cup.

I claim the balancing of said lever cup, or its equivalent, on the centre of motion, wherever placed, so that it will remain stationary, when the weight of the mercury, or other substance, is let on to either end of it—that end containing the mercury or other substance used being held down.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Annet Gervoy, of Lyons, France, director of the Lyons Railway, for means to prolong the durability of the rails on railways. February 13; six months.

Edmund Morewood, of Enfield, Middlesex, and George Rogers, of the same place, for improvements in the manufacture, shaping, and coating of metals, and in the means of applying heat. February 13, six months.

Hermann Turck, of Broad-street-buildings, London, merchant, for improvements in the manufacture of rosin-oil. (Being a communication.) February 14; six months.

Arthur Wellington Callen, of Peckham, Surrey, gentleman, and John Onions, of Southwark, in the same county, engineer and ironfounder, for improvements in the manufacture of certain parts of machinery used in paper-making, and certain parts of railways, railway, and other carriages. February 14; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Feb. 12	3119	M. Thomson	Plymouth	Telescopic Slush and tallow lamp.
,,	3120	W. Pink	Fareham	Saddle strap-bar.
13	3121	J. C. Bucknill	Exminster	Bullet mould.
,,	3122	C. Smith, A. Smith, and I. Longbottom	Keighley	Spool motion for a worsted spinning frame.
14	3123	J. Emery	Preston	Wicker-work skip with wooden bottom.
,,	3124	W. Magcough	Grenville Priest-house, Dublin.	Apparatus to ascertain the vertical height of clouds.
16	3125	Lambert and Co.	Portman-street	Vertical pianoforte brace.
,,	3126	Dunn, Hattersley & Co.	Manchester	Railway turn-table and break applied thereto.
18	3127	W. Muir and H. Goss	Salford	Theodolite.
,,	3128	W. Gaves and J. Hopkinson	New Wharf-road	Smoking tube.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

Feb. 12	361	W. Mitcheson and Sons	Limehouse	Anchor.
14	362	J. Manton and Son	Dover-street	Caster for bullets or projectiles.
16	363	W. H. Lynn	Belfast	Impervious casement cill and fastener.
17	364	S. Crossby	Cleveland-street	Cylinder, or surgical bandage roller.
18	365	J. Alderson	Clipstone-street	Economical iron joists for floors of fireproof buildings, with cast-iron braces upon wrought-iron tension.

Erratum.—In last Number, p. 128, col. 2, twelve lines from bottom, *for* "Chin," *read* "Ohm."

CONTENTS OF THIS NUMBER.

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GRINDROD'S PATENT IMPROVEMENTS IN PROPELLING MACHINERY AND IN SHIPS' RUDDERS.

Fig. 3.

Fig. 9.

Fig. 1.

Fig. 11.

GRINDROD'S PATENT IMPROVEMENTS IN PROPELLING MACHINERY AND IN SHIPS' RUDDERS.

(Patentee, Mr. Jonathan Grindrod, of Birkenhead, consulting engineer. Patent dated August 14, 1851. Specification enrolled February 14, 1852.)

Specification.

Firstly. My improvement in the machinery for communicating motion from a steam engine or other motive power, consists in a new arrangement of the parts of the mechanical movement well known as the sun-and-planet motion, with certain additions thereto, by which new arrangement and additions the shaft to which the engine power is to be communicated may at pleasure be either made to revolve at the same speed as the engine shaft, or at a greater speed, which will be found of especial advantage and economy in the case of screw and paddle-wheel steamers and of locomotive engines, and other machines requiring a greater speed than that first given off from the motive or original power, since the required speed of the propelling instruments may be obtained with a moderate velocity of the steam piston.

Fig. 1 is a front elevation; fig. 2 a longitudinal section; and fig. 3 a cross section on the line *ab* of fig. 1, showing these appliances adapted to a line of screw propeller shafting. AA are the bearings for the shafts G and *g*; of which the latter one, *g*, is immediately connected to the engine by the crank B, and is therefore going at the same speed as the engine, while the other shaft, G, is made to rotate at an increased speed, making double the number of revolutions of the shaft *g*, or, when required, any other proportionate number of revolutions, or portions of a revolution of increase (which increase is determined by the relative or proportionate sizes of the sun-and-planet wheels). The increase of speed thus communicated to the latter shaft is caused by means of the following arrangements:—B^2 is a crank, which is keyed fast to the shaft *g*; B^1 is another crank, which is slipped loosely over the end of the shaft G, upon which it is free to turn round: the two cranks B^1 and B^2 are connected together by a crank-pin, upon which there is loosely mounted a toothed wheel E, which gears into another toothed wheel D, keyed fast upon the end of the shaft G. F is a connecting rod, the upper end of which slides within the guides I I; the lower end of this rod is firmly connected by lugs and bolts to the boss of the wheel E, by which that wheel is kept from revolving when the cranks B^1 B^2 or the shafts G *g* revolve. The effect produced by the wheel E being kept in this position by the connecting rod is, that the shaft G is caused to make two revolutions for every one made by the shaft *g*. The number of revolutions thus communicated to the shaft G may be increased, or they may be lessened to any extent, even to a portion of a revolution, as above mentioned—the rate of increase always depending upon the relative sizes of the wheels employed. C is a bearing strap, two separate views of which are given in figs. 4 and 5: the strap serves to lessen the strain thrown upon the end of the shaft G and upon the crank-pin by the wheel gearing. Figs. 6, 7, and 8 show another method of securing the lower end of the connecting rod to the boss of the wheel E. In this instance, the boss is prolonged beyond the face of the wheel upon one side, and this prolongation has one portion e^1 cylindrical, for the reception of the bearing strap C, while the other and outer portion *e* is formed into a square, which takes into a corresponding boss or opening *ff* formed in the end of the connecting rod. L and K are two discs, which form a coupling between the crank B^1 and the shaft G. This coupling is employed when it is desired that both the shafts G and *g* should revolve together at the same speed, at which time the discs L and K are connected together by the pin M, and the connecting rod F is disengaged from its hold of the wheel E.

Figs. 9, 10, 11, 12, 13, and 14 show several methods of applying the mechanical arrangement above described to the transference of the power from the steam cylinders to the driving wheels of locomotive engines. Fig. 9 shows them applied inside of the locomotive frame. The engine connecting rod is attached to the two wheels E E, which are loose upon the crank-pin H, and the two wheels D D are keyed to the shafts or axles G G of the driving wheels, while the cranks B B are loose upon the shafts,—the effect of which disposition of the parts is, that both of the shafts G G, and consequently the driving wheels of the locomotive, make two revolutions

Fig. 10.

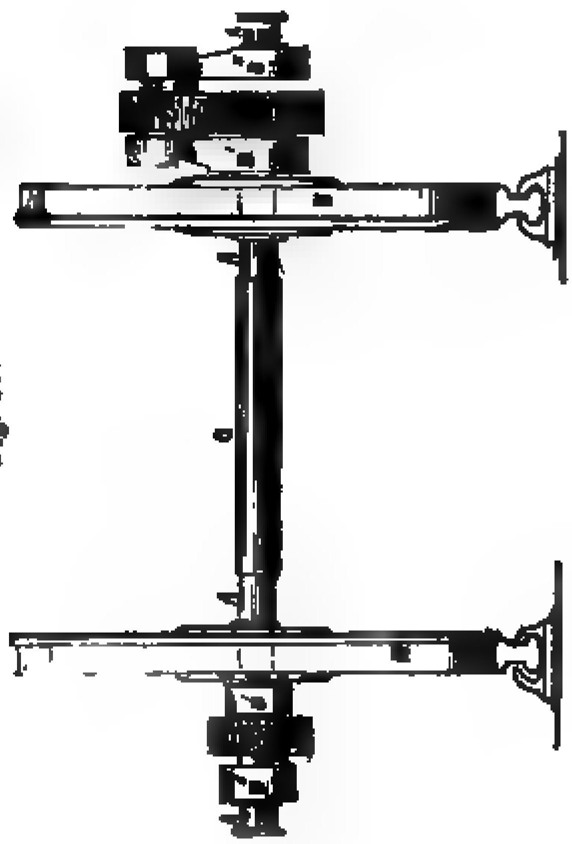


Fig. 4.

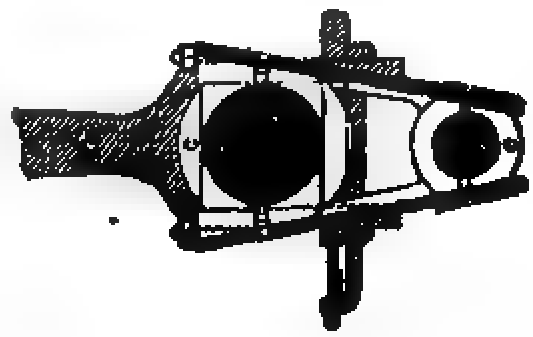


Fig. 5.

Fig. 2.

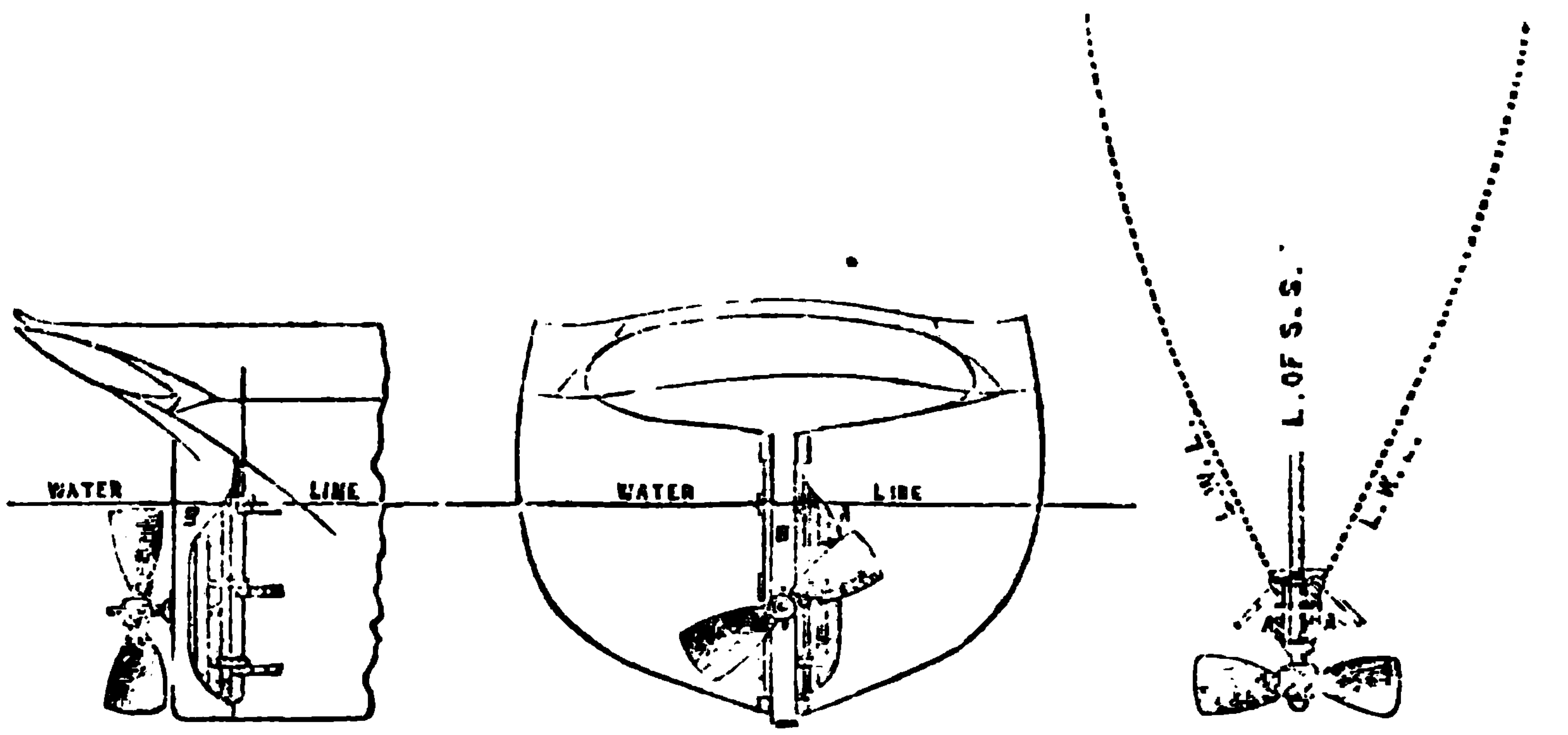
Fig. 6.

for every revolution of the cranks (supposing the diameter of the wheels E and D to be equal). Fig. 10 is an elevation of a pair of locomotive driving wheels, fitted with these appliances, for giving a double speed to them—the power being applied outside of the wheels N N. A A are the bearings or journals; G is the axle of the driving wheels, upon which the wheels D D are securely fixed, while the cranks B^1 B^1 are free to revolve thereon. The power of the engine is applied by connecting rods to the bosses of the wheels E E.

The arrangements exemplified by this figure (fig. 10) are nearly the same as those already explained in reference to fig. 1, differing only in the power of being applied to both ends of the shaft. Figs. 11 and 12 show a mode of affixing the connecting-rods of locomotive engines to the wheel E, which is similar to that before explained in reference to figs. 6, 7, and 8. Figs. 13 and 14 are a side elevation and cross-section of the arrangement shown in fig. 9, the only difference being that friction pulleys or drums EE and DD are employed instead of the toothed-wheel gearing for transmitting the power from the engine to the axle of the driving-wheels.

Secondly. My improvement in the rudders of vessels has for its object the so constructing and disposing of them that they shall be much less liable to be unshipped or injured by the vessel striking the ground than rudders of the ordinary construction. Fig. 15 is a side elevation, fig. 16 a stern elevation, and fig. 17 a

Fig. 15. Fig, 16. Fig. 17.



sectional plan taken upon the load-water line of a vessel fitted with this improvement. AA are the rudders, of which there are two, one placed on each side of the stern-post B, which is slightly recessed for their accommodation, and projects a few inches beyond the after or free edge of the rudder. One of the rudders is brought into action when the vessel is to be carried round to starboard, and the other when she is to be carried round to port. They are provided with a proper lever apparatus on deck, so that they may be worked in conjunction or separately. Fig. 15 shows the position of the rudder on the starboard side. In fig. 16 this rudder is shown in action; the other, or port-rudder, being out of action. In fig. 17 both rudders are represented as being out of action. When this improved rudder apparatus is applied to a screw-propeller vessel, it enables the builder to make a more perfect vessel, there being no aperture required in the dead wood for either the propeller or for the rudder; by which means the vessel is not only rendered stronger, but the propeller can be placed in its most favourable position. Moreover, the run of the vessel can be made fine or clean (as it is termed), by which the propeller works in a more solid and less disturbed body of water, and therefore causes less vibration to be produced in the vessel.

THE OPERATIVE ENGINEERS' STRIKE.—THIRD LETTER.

Sir,—I do not expect that the few considerations brought forward in my last letter will go far towards satisfying the operatives that they are not "oppressed" by their employers. Throughout the whole of the labouring classes there is a feeling,—a deeply rooted and powerful conviction, that they *are* oppressed. There is an impression as enduring as it is strong and vivid, that their employers *take advantage* of them, and extort the uttermost amount of work for the least possible wages. They think that wealth has *undue* and *unjust* power. And this feeling is shared by many intelligent men of all classes who abhor the very thought of "Communism" or any form of Socialism. Indeed to charge the operative engineers, as a body, with being either communists or socialists, is to bring an accusation which cannot be sustained. There is no proof that they entertain any such views, whatever may be the *remote consequences* of their principles. I shall not be far wrong in stating these principles to be: First, that the wealthy employer of labour has an unjust power over his operatives by means of his wealth; and, secondly, that to counteract this unjust influence, the operatives must combine amongst themselves, and so make the union of numbers a rampart against the aggression of wealth. In other words, the operative engineers would answer the two questions in my last letter, thus:

"1st. The injustice and oppression which we complain of, is this: Our employers make us do as much work as they can for as low wages as they can; and when we complain, they tell us that we are at liberty to do better for ourselves, to make a better bargain elsewhere if we are able. They know that if it comes to a "strike," they can hold out longer than we can; and therefore they imagine they have us at their mercy.

"2nd. The remedy for this, we believe to be in a combination amongst ourselves. By the union of our small capitals we hope to be able to compete with the large capitalists; and finally to become independent of them."

Now, to the first of these points we have already alluded; and mentioned some of the difficulties which it involves. I really cannot see how such a "case of conscience" can be settled on any general or practical grounds; or who is to be the arbiter and umpire between the opposing claimants. Suppose a wealthy employer were to accede partially to the demand of his labourers for higher wages. Take a case; and in order to fix our ideas, suppose the profits of the employer are five thousand pounds a year, and that he employs two hundred men. Here, then, is ample room for increasing wages, and still leaving a very handsome income to the capitalist. Suppose he increases each man's pay five shillings a week, then he will lose 2,600*l.* a year of his income, or more than half.

Now, would the workmen be satisfied with this? Of course they would, *for a time.* But soon they would begin to murmur afresh. After all, the employer's income of 2,400*l.* would seem too much, and they would demand a further increase of wages. Now, where is this to end? At what point shall the law of conscience, or the law of the land interfere, and say, "Thus far, and no farther?" Who is to place the limit, and where is it to be placed? Are we to go on till the income of the capitalist is reduced to the same amount as the wages of each individual? The operative will answer, perhaps, "It will be time enough to consider these things when we have got some instalment to begin with." No, Gentlemen, it will not. If it be once established as a principle that any law whatever is to interfere in these matters, every one concerned must be prepared for the consequences. It will, perhaps, be said, that Government *has* interfered in the case of women and children, in the Factories Bill; and it may be urged, that every poor man is practically as powerless to protect himself against his employer, as if he were a woman or child. That, therefore, the same reason holds good in both cases—the same necessity for Government interference. There certainly is something in this; and it is not very clear at what point we are to stop, if we once begin interfering in such affairs. In fact, the very necessity for Government protection in the case of women and children (if it be allowed) arises out of the defenceless position of the men,

for whom the same Government protection is now claimed. If the fathers and husbands were in a condition to make their own terms with the employers, they would also be able to protect their wives and children, without any help from Government. They are the natural guardians, and it is only because they have no power that any help from without becomes necessary. Poverty is, unquestionably, as great a weakener as age or sex, and puts the person as much at the mercy of others. If Government interferes in one case, there really does not appear any valid excuse for not interfering in the other. A starving man is as utterly helpless as a woman or child can be, and may be tyranised over as effectually. Let this then be granted; namely, that it is the duty—and, in fact, the express province of Government, to protect the whole of its subjects from injustice; we must still remember, that there are certain things which Government *cannot* do. For example, it cannot compel a master to give higher wages than he chooses, without thereby checking, and seriously injuring the various plans and schemes he may have in view, and by which, be it remembered, not only he, *but his workmen* would be enriched. It is true, they would not be enriched in the same degree as himself by these commercial enterprises; but it is probable, that in many, if not all, cases the labourer would ultimately lose more than he would gain by this Government interference with the plans and projects of his employers.

A. H.

(*To be continued.*)

NAVY VICTUALLING.

The victualling of the Navy being at present a subject of interest, and it having been said that science has not as yet discovered means of preserving meats effectually, it may be useful to bring together some well-known facts elucidating the subject. To begin with an immediately practicable measure,—the introduction of gelatine as an article of seamens' diet, the following letter from Sir Samuel Bentham to the Secretary of the Admiralty will best describe particulars:—

(Copy.)

19*th Dec.*, 1829.

Sir,—It has been long known that a great proportion of the constituent part of bone is a jelly, which forms a principal part of most animal soups; but it is only of late years that means have been found of separating, perfectly and economically, this jelly from the earthy parts of bones. Within the last twenty years, M. D'Arcet, and others in France, have been occupied in bringing to perfection the application of chemical processes and appropriate apparatus to this purpose, and have so well succeeded as to be able to furnish the basis of a pint of rich soup, sufficient for the portion of a working man, for less than a farthing; or the same quantity of nutritious jelly, dried as portable soup, for about a halfpenny. Soup made of this jelly (called gelatine) is now, as I understand, consumed in considerable quantities by the workmen at the Royal Mint for medals, at Paris, at a great pecuniary saving to them; and as it seems that considerable advantage might be derived by the adoption of some of these processes in his Majesty's victualling establishments, I would request you to submit to my Lords Commissioners of the Admiralty my ideas on the subject.

In the present manner of salting meat for the Navy, the bones are either disposed of for a very small sum, or remaining with the meat, are so much useless weight, occupying valuable space on board ship without yielding any nourishment. But if, as I should suggest, on cutting up the meat the bones were separated, and so prepared as to extract the 30 per cent. of gelatine, and the 10 per cent. of fat which bones are found to contain; this gelatine flavoured at pleasure, and exsiccated as portable soup, might give the ships' crews the means of enjoying frequently a wholesome and agreeable diet, keeping well in all climates, and occupying but little space, but which, as now prepared, is too costly to be afforded except for the use of the sick. The meat also thus forced from the bones would be more easily and perfectly salted, and might be rolled like Hamburgh beef previously to the putting it into cask.

I would observe, at the same time, that it is only at a Government manufactory that the operation of extracting the gelatine could be performed in a manner satisfactory to the consumer. Were it supplied by contractors, or imported from the Continent, suspicions might arise that the bones made use of may have been unwholesome, or of a kind to excite aversion — suspicions which, whether well or ill-founded, had till lately opposed obstacles at Paris to the extensive use of this most economical food.

Should their Lordships consider this proposal as worthy their attention, and desire to obtain the details of the best processes and apparatus that have hitherto been applied to the purpose, I would either point out the means by which the requisite information might be obtained, or take upon it myself to procure it, and submit it to their Lordships.

I am, Sir, yours, &c.,

SAMUEL BENTHAM.

The Right Hon. T. W. Croker.

On the 29th December, the Admiralty acknowledged the receipt of this communication, and acquainted Sir Samuel that their Lordships had transmitted it to the Victualling Board; there the matter appears to have rested. This by no means implies objection to it, since, in regard to his most beneficial proposals, reiterated requests for a decision on them were necessary ere orders were issued for carrying them into execution.

By a note of Sir Samuel's on the subject of gelatine, it appears that "The bones of the animals consumed for food in London would furnish, *daily*, a portion of soup for every individual in the metropolis."

The adoption in the mercantile navy of the measure proposed, would be no less advantageous to its seafaring men than it would be in the Royal Navy; and to steerage passengers particularly, gelatine soups would be a wholesome, cheap, and luxurious variation in their dietary.

M. S. B.

THE GREAT SCREW-PROPELLER CASE.—APPLICATION FOR PROLONGATION OF LOWE'S PATENT.

Privy Council.

February 2, 5, 19, 20, 21, 1852.

Before the Right Honourable Lord Cranworth, the Right Honourable Sir J. L. Knight Bruce, the Right Honourable the Judge of the Admiralty Court, and the Right Honourable Sir Edward Ryan.

Sir Frederick Thesiger, Mr. Montague Smith, and Mr. Webster, instructed by Mr. T. E. Wyche, appeared for Mr. Lowe the Petitioner.

Sir W. P. Wood, the late Solicitor-General, and Mr. Bovill, instructed by Mr. Cattarns, appeared for Mr. J. C. Robertson, Agent for numerous engineers, and others opposing the application.

Mr. Crowder, Q.C., and Mr. Mellish, instructed by Messrs. Garrard and James, appeared on behalf of several Screw-boat Companies, to oppose the extension.

Mr. Serjeant Shee and Mr. Bovill, instructed by Mr. Browning, appeared on behalf of the Peninsular and Oriental Steamboat Company. And

M. Vance, instructed by Mr. Chevallier, who appeared on behalf of Capt. Carpenter, a subsequent patentee.

The Petitioner's patent was dated March 24, 1838, and will, of course, expire March 24, next. In support of his application, it was urged that the principal merit of the present improved system of screw propulsion was due to Mr. Lowe, who, by his skill and exertions, had brought the same before the notice of the public;—that he had used curved blades being portions of a screw on a revolving axis below the water-line of the vessel, which had not been attempted before, and that he was entirely unremunerated for these exertions.

A great many witnesses were called on behalf of the Petitioner, to prove the utility of a blade being a portion of a screw made according to Lowe's specification, and that he had made great advances in this branch of practical science, for which he was unremunerated.

The evidence brought forward to support the opposition of the Screw-boat Companies, and by the Engineers, was directed generally to prove that the invention was old, and was in principle the same as Shorter's, and that for such share as Lowe had in contributing to the adoption of the screw, he had been amply rewarded.

We have not room to give the whole of the evidence on either side at length; but we select from the short-hand writer's notes some of the more striking portions:

Mr. Thomas Lloyd, Sworn.—Examined by Mr. Montague Smith.

Are you the Superintendent of the Department of Steam Machinery of the Navy?—Yes; I am.

Have you been so for some years?—Yes.

Were you engaged several years ago in adapting screws to steamers in the Navy?—Yes.

You are acquainted with Mr. Lowe's invention?—Yes; I am.

In your judgment, is that a useful invention?—Yes; it is a useful invention, certainly.

What is the screw now used generally in the Navy—what proportion of an entire turn of a screw do you use?—A sixth.

Has it always been a sixth that you have used in the Navy?—Yes; we determined upon a sixth in the early experiments, and it has been adhered to since that time.

Does that sixth answer in your judgment

to what is called a blade?—Certainly; the word "blade" would sufficiently express it—it might be called a blade, certainly.

Lord Cranworth.—Does that mean that the two together are a sixth?

Mr. Crowder.—No; each is one-sixth, making one-third of the whole.

Mr. Montague Smith.—I believe you were acquainted with the early experiments on board the *Rattler*, which were conducted by Mr. Petit Smith?—Yes.

Was a whole screw first used?—Half a screw; that is to say, two halves.

Did you find that that was as efficient as a smaller section of a screw?—No: it was not so efficient.

Was there more vibratory motion in the vessel by the use of it?—There might have been; I do not recollect that very distinctly.

Cross-examined by Mr. Solicitor-General.—Where did you make these experiments?—In the river Thames.

In the *Rattler*?—Yes.

How was your attention first called to the subject when you made these experiments?—The *Rattler* was built for the express purpose of making experiments with the screw.

Was it in consequence of Mr. Smith's invention?—Yes; in consequence of the attention of the Admiralty being drawn to the screw-propeller as fitted in the *Archimedes* by Mr. Smith.

It was in consequence of the *Archimedes* having been fitted, that the Admiralty thought proper to make experiments, and did make them in the *Rattler*?—Yes.

And you superintended those experiments the whole time?—Yes.

In what did your experiments consist—was it in gradually reducing the screw?—There were various objects to ascertain—that was one very important object—to ascertain the smallest part of a screw which would answer the purpose.

You wished to ascertain the smallest proportion of a screw which would answer the purpose?—Yes.

Was that wholly in consequence of Mr. Smith's experiments in the *Archimedes*?—That series of experiments was instituted with a view of fitting the instrument to ships of war, in the event of its answering; Mr. Smith had nothing more to do with it except suggesting.

Was Mr. Smith at all with you when you carried on those experiments, or did you carry them on by yourself without any assistance from Mr. Smith?—Mr. Smith was always on board the vessel; he might not have been so occasionally, but, generally speaking, he was on board the vessel as might be expected, he being regarded at the time as the inventor of the screw propeller.

Did Mr Lowe assist in those experiments at all?—No.

Did you know anything of Mr. Lowe at that time?—No.

Had you ever heard of his patent at that time?—No.

You did not know of his existence, in fact?—No.

When you went on making these experiments till you cut the screw down to the one-sixth, you had not heard of Mr. Lowe's existence?—No.

In what year was that?—The experiments begun in 1843.

You were simply led, as I understand you, to the experiment of coming down at once to the one-sixth of a turn, by a continual series of reductions of Mr. Smith's screw?—Yes.

You tried a whole turn first?—Two half turns?

Then you thought you would see if a little less would do?—Yes; and it did better; then we were encouraged to go on, and we found that the next did better still.

Till at last you got to one-sixth, and you found that that would do best?—We went a litttle beyond a sixth—we went so far till we found the result was worse—the performance of the vessel was worse.

Some expense, I presume, was incurred in those experiments?—A heavy expense.

During the whole of that expense, and of those experiments, you did not know either of Mr. Lowe's existence or that of his patent?—No.

Did you finally adopt the one-sixth in the Navy?—We finally adopted the one-sixth.

Was that entirely as the result of your own experiments carried on in this way at your own expense?—Entirely. It was at the expense of the Government. I ought to mention that other experiments were made besides those in the *Rattler*, before we ultimately determined upon a sixth. A series of experiments were made in the *Dwarf* also, which were more numerous than those in the *Rattler*, with a view of determining the proper pitch of the screw and various other things.

Was any vessel built for the express purpose of the experiments?—The *Rattler* was built for that purpose.

Among other things, you also say you made experiments upon the pitch?—Yes; that was done chiefly in the *Dwarf*.

The extent of the pitch is also important, is not it?—It is.

It is desirable that that should be defined in any paper which you would lay before a workman for constructing a screw?—Cer-

tainly; some principle should be laid down —some limit should be set.

I see there a model, do you know that model?—Yes; that is a model which shows the *Rattler's* screw.

That is the result you arrived at in the *Rattler?*—That is one of the many screws we tried; we tried, I dare say, thirty screws in the *Rattler*.

That is the last you arrived at?—I am not sure that it is the last.

It is one of those you arrived at?—Yes.

Fixed as that is, in the dead-wood, and when put upright in that form, not impeding the progress of the vessel in the water?—Very little; the screw is drawn up through a trunk, and is got rid of altogether. I may mention that the *Rattler* had a large aperture, with a view of accommodating the vessel for a long screw; and those pieces painted blue were temporary pieces, put in ,in order to see whether the aperture might be reduced in size without reducing the efficiency of the instrument before other vessels were built.

When you ultimately arrived at what you thought the best form of screw, such an aperture was no longer necessary?—No; before it was acted on it was desirable to see whether the filling up the aperture would lessen the efficiency of the screw.

I understand you to say that is what is generally adopted in the Navy?—Yes, one-sixth. I am not sure whether that is less than one-sixth.

Having arrived at that result with very great expense, if you were employing any workmen to make a screw, would it not be an object of considerable importance to define at once to him the exact amount, and the shape and form of the screw which you wished to produce?—Yes.

The exact proportion of it to a whole turn?—Yes.

Otherwise the workman would be left to discover it by his own experiments, as you did by yours?—Yes.

You conceive a definition of the exact proportion of a screw to be an object of very great importance in reference to its efficiency?—There are tolerably wide limits within which you may make a screw, without materially diminishing its efficiency; it might be a seventh, or an eighth even, or more than one-sixth.

What would be the smallest and the largest limit which, in your judgment, after all these experiments, would be beneficial?—I think less than one-ninth or one-tenth would not produce a good propelling instrument, or I should rather say, would not produce so good a propelling instrument as one-sixth.

And more than how much?—A whole screw is not a bad propelling instrument; that is, the two half turns: but it is not so good as the other. The inquiry was with us, not how large a propeller you might have, but how small a propeller you might have.

What was the object of not having a large propeller?—That it should be lighter, and occupy less space in the deadwood of the vessel, and should be drawn up more easily.

Larger ones, I suppose, could not be drawn up conveniently?—Not conveniently; they could be drawn over the side of the vessel.

When you speak of considerable expense, can you give any rough statement of how many thousand pounds were incurred in those experiments?—I should be afraid to say how much.

Some thousands of pounds?—Yes; you may consider that the *Rattler* was built for the purpose.

Though you did not know anything of Mr. Lowe, or his patent, at that time, have you looked at his patent since?—I have heard of it so often, that I know it pretty well.

Supposing, before you had yourself incurred the great expense of those experiments, you had had the advantage of having his patent put before you, would it have prevented that expense? Should you have been able from that patent to have made the machinery in the form you have now arrived at?—I do not think we could have taken any other course than we did take—that of experimenting from one extreme to the other. I do not think any one would have believed that such a propeller would answer as well as it does.

Do you know the proportion of that? (*pointing to a model.*)—I think it is about one-sixteenth; I have heard that mentioned. It may be one-twelfth or one-sixteenth, judging by the eye.

The lowest dimensions to which you recommend any party to proceed is one-tenth, I understand you?—Yes; but as I said before, there is no definite limit which can be fixed; for particular purposes, one-twelfth may do.

At present, for the Navy, you have entirely adopted this, as I understand?—Yes.

Cross-examined by Mr. Crowder.

I do not think you said *when* you became acquainted with Mr. Lowe himself, at all —when you knew there was such a person? —I do not recollect. It was a good while after those experiments.

When did you become acquainted with the fact that there was such a thing as Lowe's Patent?—It was after those experiments.

Was not it considerably after you had

arrived at a conclusion on the subject?—I really cannot tell when I knew of Mr. Lowe's patent.

Were your experiments made publicly?—Oh yes; everybody might go on board the vessel to see them.

It was a matter of notoriety that the Admiralty were endeavouring to ascertain the fact?—Yes; the Admiralty were too happy to see any one interested in the experiments.

Did Mr. Smith give you very useful assistance in those experiments?—Yes.

I believe he received some payment or salary, did not he?—Not at that time; he had that as the inventor of the instrument.

Do you know the *Archimedes?*—Yes.

That was somewhat larger than this?—It was two half turns.

Who was it suggested reducing the screw so as to make it somewhat less, was it you?—I really cannot tell; it was so natural and obvious a course to pursue.

It was the natural course to pursue when you found that two half turns would do, to see if a little less would do?—Yes.

And did you arrive by a natural conclusion to what you see there?—Yes.

And that is what Mr. Lowe claims for his patent?—Yes.

You have seen the specification?—Yes.

What is the meaning of that hook? (*pointing to drawing annexed to specification*)—I cannot tell.

What do you infer from that, as a practical man, seeing a hooked blade like a bill-hook there? Is it of any practical use whatever, in truth?—I should think not.

Is not it the reverse?—So long as the surface remains the same, I imagine it would not make much difference; of course it is a more awkward instrument, because if this were increased to the size we have found necessary, it would require a larger trunk, and so on.

With respect to that larger trunk, would not it be an inconvenience, reducing its utility to some extent?—Yes, if you are to adhere strictly to that form.

There is nothing in the language of the specification to guide you, except that it is to be a blade, and that blade is to have a curvature?—Yes.

There being nothing to guide you in the words of the specification, looking at that drawing a person acting under that drawing, and using that configuration, would use something rather prejudicial than the reverse?—Yes; I should prefer a straight line to a curved line.

On that ground the trunk would be more inconvenient?—Yes; this is less expensive to make.

What do you call the trunk?—The trunk is the square trunk through which you draw the screw when it is not in use. If you had this hook here, it must be wider than if the same surface were included between straight lines.

Upon the whole, your judgment is, that that configuration is of no manner of utility, but rather the reverse?—Yes; I should prefer a straight one.

Looking at that blade, without any language referring to it, can you tell at all what portion of a screw it is, or whether it means to indicate anything else than a sort of blade?—The drawing affixed to the specification do you mean?

Yes; looking at that as a practical man, does it mean to indicate anything else than some blade, and that curvature?—Only one infers from that nearly the portion of an entire screw, which it is intended to be.

How would you ascertain that from the specification?—From the drawing; from the drawing one can tell what portion of the entire circle the end view of the screw occupies; you would see what portion of the entire circle the blade was.

Would not that depend upon the pitch?—No; it does not matter what the pitch is when you look at it endways; a sixth would always be represented by the same picture, whether the pitch were great or small.

Can you by any admeasurement, looking at that, arrive at a conclusion what portion of a turn of a screw that is?—Yes; roughly you may.

And that is one-sixteenth?—Perhaps not quite so much; I have not measured it.

How low have you ever gone in practice or experiment?—I think we have gone as low as a ninth or a tenth.

You have gone to as small a portion as a ninth or a tenth?—Yes.

And not lower?—I do not know of a lower experiment.

Was that because when you got below a sixth or a seventh, you found a gradual reduction of the efficiency of power in the screw?—Yes; but not very material.

But still you found an alteration the wrong way?—Yes.

Did you then put it up again, and ascertain that it really was that?—Yes; we repeated the experiment.

And putting down and then raising it you found, as you diminished from a sixth or a seventh, you got less power?—Yes.

You say those two half turns form a very efficient means of propelling a vessel?—Yes; the *Archimedes* beat the Dover packets at that time.

Going nine knots an hour?—Yes.

With those two half turns?—Yes.

Can you tell whether the one-sixteenth

which is represented in those drawings would be such a proportion as would be an improvement upon this?—No; I think that would be better than one-sixteenth.

In your judgment, is there any merit in a person saying, You may propel a vessel with one-sixteenth, when you have already found out and used practically this, which is two half turns of a screw, and could do better with it?—Any person who makes a suggestion of that kind is likely to do a great deal of good, if it come at the right time, before any other person has discovered the same thing. If any person were to make experiments, and tell the public the result, and it were to lead the public to adopt it, that would be an advantage.

As far as you have made experiments, they would go to show that this, with one-sixteenth, is not so good as two half turns?—Yes; I do not think one-sixteenth was ever tried.

Has your experience been very large as regards the experiments made from time to time upon this screw, and all portions of it?—Yes; I know a good deal about them.

You are aware of Ericsson's invention?—Yes; I have a general knowledge of it.

You know that he used a portion of a screw?—Yes.

To any practical man, did that show a portion of a screw to be used, though in this configuration?—Yes; in a very different way from that which is now used.

Have you tried any of the flat blades? (*pointing to one of Taylor's*)—Yes.

This becomes a very good propeller, I believe?—Yes; it is not quite so good as the other, but it is not a bad one.

The effect of the propulsion is by the operation of the two blades in the water?—Yes.

And these two blades do cause a very considerable propulsion?—Yes; it is not a bad propeller, by any means.

Have you ever tried one against the other with the same area, so as to know whether there is any real difference?—We have tried the flat blades, and the result of those trials has been to lead us to abandon them in favour of the curved blade—the curved blade being a little better.

Is that the only difference between these two, that one is a little better than the other?—Yes; I should prefer the screw for other reasons.

The essential force in propulsion is derived from there being two blades like those of a windmill?—Yes; the oblique action of the two blades upon the water.

The advantage of the screw, you say, is a little greater; probably its allowing the water to get off a little quicker; is that so?—If you have flat blades, in order to make it an efficient instrument, you must not carry the flat down to the centre of the screw, or it would be exceedingly injurious.

It would be cut off as it is even here?—It ought to be cut off more than that; and then you have to carry the outer end of the propeller upon thick arms. The best way of carrying the outer part of the propeller is, by continuing the screw down to the very centre.

You get somewhat more strength, do you?—Yes; and less resistance through the water. The centre part of the screw should be regarded as that which carries the outer part, rather than as the propelling power.

Were there other vessels employed at a considerable expense besides the *Archimedes* and the *Rattler*?—Yes; the *Dwarf* was one.

Any other?—Experiments have been made in other vessels.

Were those other experiments attended with considerable expense?—With great expense.

Could you have arrived at any such conclusion as that which you now have without going to a very considerable expense indeed?—We could not have arrived at it, because experiments must have been made on a large scale to be worth anything; experiments on a model are not worth much.

Cross-examined by Mr. Vance.

Were you in Her Majesty's service in the year 1838?—Yes.

Had you made any experiments before those tried by Mr. Smith in the *Archimedes*?—I think never.

Did you ever go to Mr. Taylor in the year 1838, to see some models of screw propellers?—Not that I recollect; I recollect going to Gracechurch-street to see some models after that.

At what time was that?—After the trial of the *Archimedes*.

Before the *Rattler*?—I cannot tell.

Was it after the *Rattler*?—I cannot tell when it was.

Was it in 1842 or 1843; can you tell us within three years?—I cannot.

Were you ever ordered by the Lords Commissioners of the Admiralty to witness Captain Carpenter's experiments?—No.

Are you aware whether Mr. Ewart was ever there?—Mr. Ewart has seen them.

In the year 1838?—I cannot tell.

Do you know how the Lords Commissioners of the Admiralty arrived at that particular screw which is in the *Rattler*?—Yes.

By what means?—By cutting down a whole screw, like that which was fitted to the *Archimedes*, till the proportion of a

whole screw which would produce the best effect was found.

In what year did they begin to cut down? —In 1843.

Are you aware whether, prior to 1843, a patent was taken out, describing the angles at which the screw propeller should be set, and the proportion of a screw to be used? —No, I have no knowledge of that; I may mention, with respect to the use of the word "angle," that when you speak of the angle of a screw, the angle varies from the circumference to the centre, therefore you must say the angle of what part you mean.

Are there certain angles within which a screw propeller is useful, and without which it is useless?—Yes.

Can you describe them?—Not the angles; you may measure the angle of the screw, but the better way of looking at it is to speak of the pitch, to see the length which one convolution of the screw will make. If this thing were wound round a cylinder, this representing the two threads of the screw, the distance from that thread to that, measured in a line parallel to the axis, is called the pitch of the screw, and the relation of that to the diameter gives the screw entirely.

Is there a limit within which a useful propeller can be made, and without which it would be useless?—Clearly; there are very wide limits.

Can you state them?—The limit one way certainly would be, that the pitch of the screw should not exceed twice the diameter; that would be a wide limit on the one side; we should not like the pitch to exceed more than once and a half of the diameter. On the other side, we should not desire the pitch to be less than the diameter of the screw.

Then it is necessary to ascertain what the pitch of a propeller must be?—Certainly.

Do you know Mr. Lowe's specification? —Yes.

Does that guide you?—Not at all as to the pitch.

In order to make the propeller which is now used in Her Majesty's service, it would be necessary to ascertain what the pitch should be?—Generally.

Were you ever on board the *Geyser* steam frigate?—Yes.

Was she fitted up with a screw?—No; she had paddles.

Was the pinnace of the *Geyser* fitted with a screw?—No; not a screw, it was a propeller consisting of two planes.

Are you aware whether Captain Carpenter, in the year 1839, or 1840, or 1841, ever mentioned to the Admiralty that he had an invention?—I have no doubt he did.

Why do you say so?—I have read a letter of Captain Carpenter's since, stating that he did.

Are you aware whether Sir Edward Parry was there?—Yes.

Did he witness the experiments of Captain Carpenter?—I cannot say.

Are you certain that Captain Carpenter made experiments as to screw propulsion prior to the year 1843?—I have no doubt about it, though I cannot speak from my own personal knowledge; when you speak of screw propulsion, I am not aware that he has used the screw at all.

You do not know whether the pinnace of the *Geyser* was fitted up with a screw on that plan?—I know it was fitted up with a plane; it may have been fitted with a screw also.

Did you ever see the drawings of Captain Carpenter?—I have seen copies of them.

This patent was taken out in 1840; will you tell me whether that represents the screw propeller now used in the Navy?—(*A drawing being shown to the Witness*).—Yes.

In what respect?—It is a portion of a screw.

What portion of a screw would that be? —I cannot tell that from that view of it. You could tell if you had the other view of it.

Supposing you put a pair of compasses there, and described a circle, you could tell what proportion of the circle it was?—No; you are looking at it in the wrong way. This axis indicates that this is a side view of the screw; this tells you the length of the screw, but not the portion of the entire circle; you must look at that end, at the axis to tell you the proportion of the screw.

In what points do you consider that that represents the one now in use in the Navy? —In its general appearance.

Is that (*another model*) the kind of thing which is used in Her Majesty's service?— Yes; it is very much like it.

In all the Queen's ships do they fit up the screw with a sixth portion of the screw? —Yes; there may be exceptions.

There are none as low as one-sixteenth? —No.

If you were told to make a screw according to that drawing, and you were not told the angle, should you make a thing like that?—I cannot tell.

Assuming this to be a model made from that drawing and specification of Captain Carpenter's, is it at all like the screw of the *Dauntless*?—Yes; assuming that to be the case, it is very like it.

Is it at all like Mr. Lowe's?—Yes.

In what respect?—In respect of the curvature of the surface.

Only in respect of the curvature of the surface?—And it is about the proportion.

Should you say that is one-sixteenth or one-sixth?—I should say it is more like one-sixth.

Should you say that Mr. Lowe's is more like one-sixth?—Mr. Lowe's is rather more like one-sixteenth, but the two screws are very much alike in their general appearance.

Do you know what induced the Admiralty to fix on one-ninth for the *Rattler*?—It was one of the screws which had been cut down.

Do you know what induced them to fix on one-ninth?—They did not fix upon one-ninth or one-tenth.

What led them to go to one-sixth?—It was arrived at from gradually reducing the length of the screw; the screw was reduced from time to time till we got past the sixth, and got a worse screw than the sixth.

At the time that the *Rattler* was fitted up, you never heard of Mr. Lowe's patent, you say?—No.

Did you ever hear of Captain Carpenter's patent?—I think it is probable I did, but I cannot tell.

Did any of the Lords Commissioners, to your knowledge, know of it?—No doubt they must have known of it, because Captain Carpenter wrote to them upon the subject.

Was not it in consequence of Captain Carpenter's urgent request that the screw was introduced into Her Majesty's service? —No.

Are you aware that he has written constantly to the Admiralty on the subject?—Yes.

Lord Cranworth.—We are not very strict about evidence, but I do not see what this has to do with it.

Mr. Vance.—I wish to show that Captain Carpenter brought this before the notice of the Admiralty, and that therefore Mr. Lowe has no merit.

Lord Cranworth.—What does it signify to the question before us who brought it to the notice of the Admiralty? The question is this: The moment Mr. Lowe obtained his patent, do you contend that they immediately found it out from the patent? You must proceed upon that argument; whether they learned it in any other way is quite immaterial. I am sure their Lordships do not wish to stop any reasonable inquiry; but upon the question of whether it is reasonable to extend the patent, we are going into the case at a length which would hardly be very legitimate at a trial at *nisi prius* when the question of the validity of the patent was in issue.

Mr. Vance (to the Witness).—You are quite convinced that when the *Rattler* was fitted up, you had never heard of Lowe's patent?—I am quite satisfied of that.

And you think you had heard of Captain Carpenter's?—I may have heard of his experiments.

Re-examined by Mr. Montague Smith.

You tried in the *Rattler* first the two half turns?—Yes.

That was long after Lowe's patent?—Yes.

Was that done under the superintendence of Mr. Pettit Smith?—No; I should say it was rather done under my superintendence.

Was Mr. Pettit Smith on board at the time?—Yes; he was always on board, and a dozen other people were on board who were interested in screw propelling.

And Smith's patent was for a whole screw?—It was for a whole screw.

Whether he knew of Mr. Lowe's, you do not know?—I do not.

The *Rattler* was very much built as an experimental ship for the purpose of trying this new propeller, was not it?—Yes; she was built exactly like a paddle-wheel vessel, in order to try the two.

At first you hardly believed that a smaller section of a screw would do?—No; I had no reason to believe so: I had no reason to think that a blade would answer the purpose.

Are flat blades in use in the Navy, or in the merchant service?—They are not in use in the Navy, and not extensively in the merchant service.

Sir J. L. Knight Bruce.—I understand you to say that no one would have believed that such a propeller as Lowe's would answer as well as it does?—Yes; when I say as Lowe's, I should say so without going quite to the extreme smallness of Lowe's.

Lord Cranworth.—I understand you to mean that no one would have believed that a small section of a screw, adequately described by a "blade," would have been as useful as it is?—Exactly.

Mr. Solicitor-General.—Will your Lordship ask Mr. Lloyd if he was aware of Shorter's invention?

Lord Cranworth.—Were you so?—I do not recollect; I may have seen the thing, but I do not recollect.

Mr. Solicitor-General.—At what time did you hear of Shorter's invention?—I think not till some of these trials began.

Lord Cranworth. — Quite recently?—Within seven or eight years, possibly; before that time, these patents did not excite any interest in the mind of anybody.

Captain Carpenter was also examined.

The chief points which his evidence went to establish were as follows:

He said that he had great experience in screw propelling, having turned his attention to it for more than twenty-five years; that he understood the subject both practically and theoretically. He said, that however simple the screw propeller might appear in its present form, it was a very fine and delicate instrument.

There were many points which it was necessary to ascertain in constructing it, the principal of which were the area of diameter of the blade, the proper curve, and the angle at which the blades should be set on the shaft.

All the patentees of a section of a screw, as he believed, prior to himself, had taken the windmill vane as the basis or principle on which they had formed the propeller; and it was to that fact that he chiefly attributed their failure in success. Now the arms of the windmill vane were not in the form of a perfect screw until they were in action. The vanes were so formed as to adapt themselves to the wind, and were totally different in principle from the Archimedean or water screw. It was also essential that the pitch of the screw should not be greater than twice its diameter or less than once; in fact, that the pitch should not be more than 45° or less than 20°. These were the limits within which a propeller must be confined in order to render it efficient in the propulsion of vessels.

The angle of 30° produced the greatest speed.

All these particulars were defined in his specification, and it was impossible to ascertain those points from Lowe's specification.

That he was appointed to the *Geyser* steam sloop in the early part of the year 1842. That, prior to his departure from England, he, by the direction of the Admiralty, fitted up the pinnace of that vessel with his screw propeller.

That he gave all the information he could afford respecting the virtues or properties of the section of a screw to Sir E. Parry and the Government engineers. That he made various experiments on that pinnace in the Thames and in the Regent's Canal, in the presence of the Directors of the Grand Junction Company. That he tried his section of a screw with Smith's whole screw in the *Polypheme*, and it was found to be superior.

On his return to England in 1845, he found that the *Rattler* was fitted with his patent screw propeller.

That he had frequently applied to the Admiralty for the money voted for the invention. He was told that it was a matter of law.

He had been waiting for a decision on the action of Lowe *v.* Penn, and it was not concluded till the year 1850, and it then ended in a compromise.

Finding that Lowe's Patent expired in March, 1852, he chose rather to wait and oppose its prolongation, than embark in the expense and uncertainty of litigation.

Neither Smith's, Ericsson's, Woodcroft's Lowe's, or Blaxland's propeller was at all similar to that now used in Her Majesty's ships, excepting in principle, and the principle had been known for ages.

He had advocated the case of Mr. Taylor before the Admiralty, because Taylor had invented the trunk or framework which was used in connection with his (Captain Carpenter's) screw in Her Majesty's ships.

He claimed the screw now generally used to be his invention; no vessel was ever fitted with it until long after his patent in June, 1840.

Decision.

LORD CRANWORTH,

Their Lordships have considered this case, indeed we have had long opportunities of considering it from time to time during the hearing, and we are unanimously of opinion, that no case has been made which warrants us in recommending an extension of the Patent.

It is undoubtedly perfectly true, that in considering a question of this sort, their Lordships do not enter into the inquiry whether the Patent, as it now exists is, or is not valid. That is not a matter for us to decide upon; that is to say, it is not for us to decide upon unless a case should present itself in which it is clear upon the face of the Specification, or the Patent, that it is bad, in which case their Lordships would not be ancillary to extending that which might lead to useless and protracted litigation. But *primâ facie*, where a patent has existed for fourteen years, in considering whether a case has been made for its extension, we are, and I believe all those who have sat in the same place and exercised the same functions which we are now exercising, have been, pretty much, in the habit of assuming, unless the contrary be as clear as daylight, that that Patent is valid.

Still we cannot help looking at the Patent and the Specification collaterally, with a

view of seeing whether or not it is expedient to recommend an extension. And here, though we are very far from saying that the Specification is not perfectly legal and good, so as to warrant the actions which have been brought, or any other actions which may be brought for an infringement of the Patent during the fourteen years for which it was originally granted, et we cannot but feel that the terms of the Specification are unfortunately vague, and not quite calculated to afford that clear information to the public which it is to be wished at least, the Specification should have given. It does not point out the extent of the circle or portion of a screw which is to be used, and it is in two or three other particulars less definite and distinct than could be desired.

The truth is, it appears to their Lordships that the real discovery in this case is a discovery which was made quite independent of Mr. Lowe's Patent. It was a discovery which was made by the expenditure of the money and the time of the Admiralty in investigating by a sort of process of exhaustion this question; take a whole screw, cut it down from time to time, and so ascertain what is the portion of the screw, which being left adhering to the axis, forms the best propeller, and the result of the very long and expensive experiments which on that subject were made by the Admiralty, has been, that a portion of a screw, fluctuating according to the size of the vessel and other circumstances not yet accurately ascertained, but generally consisting of from one-eighth to one-sixth of the entire circumference, has been proved to be the best propeller.

Now, to arrive at that conclusion, Mr. Lowe's Specification, and therefore his Patent, rendered scarcely any assistance. Without the drawings it would render no assistance, because all which is said is,—It is to be a portion of a screw, which, as was repeated, and necessarily repeated over and over again in the course of the argument, may mean $\frac{99}{100}$ths of the entire revolution of a screw, or $\frac{1}{100}$th of the entire revolution of a screw. Therefore we think, giving credit to Mr. Lowe for a valid Patent, that this was a discovery which, as regards its practical use, was made not by means of Mr. Lowe's Specification, but independently of it. The proof of which is, that in point of fact, the experiments of the Admiralty seem to have been carried on throughout without the knowledge on the part of any of those who conducted them, of the existence of Mr. Lowe's Patent at all. We do not think therefore that Mr. Lowe's Patent can be treated as one which has conferred upon the public the real benefit of the discovery of the best sort of propeller.

Now, although no real practical benefit may have been shown to have resulted; yet, assuming the Patent to be valid, perhaps a claim for extension right might have been established if Mr. Lowe could have shown that he had great merit in having made a valuable discovery, or that in making this valuable discovery, or a discovery more or less valuable, he had expended large sums of money and great labour, which had not been productive to him. We have not lost sight of that consideration; but their Lordships have arrived at the conclusion, however willing to think favourably of Mr. Lowe,—and they have not the slightest reason to suppose him otherwise than a very honest and honourable man,—that inasmuch as he has not thought fit to come here as he might have done, to tell us what labour he expended, what thought he devoted to these inquiries, and how far he made experiments which led him to that discovery for which he eventually obtained the Patent, they cannot attribute to him any merit. He has not thought fit to come forward and present himself to explain those circumstances. We do not consider therefore that there is any case made out which we can regard as a case of unrequited merit.

Has there been any unproductive expenditure on the part of Mr. Lowe? Here again we are of opinion that nothing of the sort has been shown. There is a little complication with respect to the accounts; but the result, as stated on the part of Mr.

Lowe, is this,—that at the present moment he is a loser to the extent of somewhat short of 50*l.* But there are outstanding demands of about 1,000*l.*, in respect to which he claims one-third, which would more than compensate the loss of that 50*l.* It may be said that the Patent has been unproductive to him in point of money. That may be; but as far as Mr. Lowe is concerned we do not think that that affords any foundation for the application for an extension of this Patent.

Mr. Lowe seems to have been, no doubt, a very respectable person, a workman in the employ of Mr. Shorter, who obtained a patent more than half a century ago. In that employment he would necessarily learn much which might be of valuable assistance to him towards obtaining a patent of this description; but what was the exact invention which he had made when he came to obtain a patent, is a matter left in entire uncertainty, and we cannot but feel extremely doubtful whether he had, up to that time, made any really valuable discovery at all.

Then with respect to the expenditure of money. That expenditure consists in the purchase of a boat which is lost. Suppose that was fairly to be attributed to the experiments which were going on, still the only result is, that there has been neither gain nor loss.

That is, taking the accounts as Mr. Lowe has represented them, and as they were adopted by the contract between himself and the other Patentees, who entered into what has been called the Deed of Amalgamation. But their Lordships must not be understood as assenting to the terms of that amalgamation as affording any rule which can guide us. The arrangement may be right, or it may not be right; but where a patentee chooses to come to an arrangement with other patentees, and to say, "The joint profits of the five patents shall be divided among us on such terms as that I shall take a third of them;" in considering whether that party is entitled to an extension of his patent upon the ground of expenditure which has been made, we cannot adopt that as being a correct mode of dealing with the matter. I very much doubt, in truth, whether we ought not to debit him with the whole, unless he can establish as to all the others that they have rights which are adequately represented by their proportion of the joint fund which has been attributed to them. The arrangement was, no doubt, thought for the best; but on a question of this sort, we are not aware of any case in which that sort of partnership of several patents has been dealt with upon the footing that, because it has been unproductive to one of the patentees, their Lordships should be called on to recommend the extension of the Patent.

We have bestowed upon the case the fullest consideration, and we are of opinion that there has not been a case made out, either of unrequited merit or unproductive expenditure, which warrants us in recommending the further extension of this Patent.

TAYLOR'S FLAT-BLADED PROPELLER.

Privy Council.—February, 1852.

The Council gave also their decision this day on an application made by Joseph Jepson Oddy Taylor, for the renewal of Letters Patent granted May 1, 1838, to him for "An improved mode of propelling ships and other vessels in water." Their Lordships refused this application so far as regarded the flat-bladed propeller; but granted an extension of it for four years, so far as respects the employment of the hollow trunk, through which to raise and lower screws, of which Mr. Taylor appears to have been the first inventor.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING FEBRUARY 25, 1852.

Henry Glynn, of Bruton-street, Berkeley-square, gentleman, and Rudolf Appel, of Gerrard-street, Soho, anastatic printer. *For improvements in the manufacture or treatment of paper, or fabrics, to prevent copies or impressions being taken of any writing or printing thereon.* Patent dated August 14, 1851.

This invention consists in preventing the transferring of designs from printed, en-

graved, or written documents, by impregnating the paper or other fabric with a solution of salt of copper (by preference nitrate or sulphate of copper), and then applying an alkaline solution, which is preferred to be that of phosphate of soda, so as to produce a cupreous precipitate, insoluble in water, on the face of the paper or fabric, which precipitate shall be capable of being acted on chemically by the surface or material employed to produce a transferred impression.

The salt of copper may be applied in solution to manufactured paper, or it may be introduced into the pulp in the process of manufacture: — One ounce of nitrate of copper, or its equivalent of sulphate of copper, is sufficient for two gallons of pulp. The paper having been impregnated with the salt of copper solution, and treated with an alkali, to produce an insoluble precipitate of the copper in the form of hydrated oxide, or other salt, is subsequently immersed in a saponaceous solution, composed by adding to a solution of an alkali as much fixed oil (not a drying oil), as it will readily convert to soap, and then mixing therewith an equal quantity of old palm oil. Or it may be composed of equal parts of white soft soap and old palm oil. Half-a-pound of this mixture, dissolved in one gallon of hot water, forms a solution suitable for use, as above mentioned. The saponaceous solution may, if thought desirable, be employed without previously impregnating the paper with a solution of salt of copper.

The patentees do not confine themselves to the use of salts of copper, as those of lead and zinc may be employed, as well as other metallic salts which are known to possess the property of being acted on chemically by the surface or material employed to produce a transferred impression from a written, printed, or engraved document.

Aime Nicolas Derode, of Rue St. Roche, Paris, gentleman. *For a certain process for uniting cast iron to cast iron and other metals, and for uniting other metals together.* Patent dated August 14, 1851.

Mr. Derode's process of uniting metals to each other consists in the employment, in conjunction with ordinary heat, of a succession of electric or electro-galvanic shocks. The metals may be operated on either in the solid or partially liquid state. The metals are first scoured with acidulated water, the effects of which may be aided by heat and electric agency, then rubbed with wire brushes, placed in contact with each other in the position they are ultimately intended to occupy, have solder applied at the meeting parts, are heated by means of a clear fire in a suitable furnace, and, while the solder is melting, a rapid succession of electric shocks is caused to act on the two metals so as to combine with the solder, to produce perfect union of the two. The solder which the patentee prefers is composed of two parts yellow copper solder, one part brass, and one six-hundredth part nickel in powder; but other may be used, and these proportions may be varied. The joint produc by the process described is stated to be so perfect as to be capable of resisting a force more than sufficient, in the case of two bars of iron united together by it, to fracture the bars.

Claims.—1. The uniting of metals by the agency of electricity (either magnetic or electro-galvanic), with the usual scouring process, and with the addition of ordinary heat.

2. The combining electric agency (either magnetic or electro galvanic) with the scouring process.

3. The application of an electric multiplier to the scouring process and to the soldering of metals.

John Walters, of Sheffield, manufacturer. *For certain improvements in knives and forks.* Patent dated August 21, 1851.

Mr. Walters's improvements have relation to balance-handled cutlery, and consist in producing the requisite preponderance of the handle over the blade or prongs of knives and forks by means of an elongated solid metal bolster, in conjunction with a greater length of tang than is ordinarily employed. The bolster may be made in one piece with the blade and tang, or it may be made to slip over the tang, and be soldered firmly thereto. In the case of silver dessert knives and forks, the tang would be made of an inferior metal and soldered to the bolster. The bolster also of ordinary knives may be ornamented by being electro-plated or gilded.

Claims.—1. The lengthened bolster and tang for knives and forks, whereby to produce the balance or preponderance of the handle.

2 The electro-plating or coating the bolsters of knives and forks.

James Robberton, of Oxford street, Manchester, chemist. *For improved methods of producing or obtaining printing dyes and other substances used in printing, which improvements, in whole or in part, are applicable to other like useful purposes.* Patent dated August 21, 1852.

Claims.—1. A method or system of extraction described, in so far as respects the manner of combination therein in one connected and continuous series of the pro-

cesses of feeding, treating, lifting, and discharging, whereby the materials from which the extract is to be obtained are supplied at the bottom of the apparatus, and the liquid solvent at the top, and the former are, by successive liftings, raised to the top in a more or less exhausted state, while the latter, with the extractive matter, gravitates successively to the bottom, and is there collected in a state fit for use, without that long exposure to the deteriorating effects of heat which attends the ordinary methods of extraction, and without the necessity for using pumps or exhausting apparatus for separating the extract from the materials under treatment.

2. A mode of obtaining dry extracts of meat, in so far as respects the combination of the mode of evaporating the same to dryness, with the subsequent mixture of the same in certain cases with gelatinous or farinaceous matter, as articles of food.

3. Certain mechanical arrangements, whereby the extract or substance to be evaporated is supplied to, and then made to pass over, by its own gravity, as often as necessary, a large amount of heated surface in thin films, and whereby it is speedily reduced to the required consistency.

4. The combination of a revolving cylinder or cylinders with scrapers, whereby the extract, by adhesion to the external surface of such cylinder or cylinders so heated, is brought up and round to the scrapers for collection in a concentrated mass.

Lot Faulkner, of Cheadle, Chester, machinist. *For certain improvements in the method of obtaining and applying motive power.* Patent dated August 21, 1851.

Claim.—The obtaining and applying of motive power by means of counterbalance weights, which are so arranged as to counterbalance each other during the return stroke of the engine, and thereby to require little or no expenditure of power in returning to their original working positions.

John Tresahar Jeffree, of Blackwall, engineer. *For an improved apparatus for facilitating the more perfect combustion of fuel, whereby funnels in steam vessels, and chimneys or shafts for factories, may be dispensed with.* Patent dated August 21, 1851.

The object of the present invention is to produce a more perfect combustion of the gases, and other products arising from steam-boiler furnaces than has been hitherto obtained, and this is effected by causing the products of combustion to be drawn from the flues by a rotating fan, or other contrivance, and to be mixed with such a proportion of atmospheric air as shall insure their combustion; after which the gases so mixed are returned to be consumed in the furnace.

Claims. — 1. The apparatus described wherein the products of combustion are intermixed with atmospheric air, and are then returned by the action of a fan-blast, or otherwise, to the furnace, and are for the most part consumed.

2. The regenerating bridge described, between which and the ordinary furnace bridge the products of combustion are caused to pass.

George Laycock, late of Albany, New York, dyer, but now of Doncaster, tanner. *For improvements in unhairing and tanning skins.* Patent dated December 1, 1851.

1. *Unhairing Skins or Hides.* — The skins are first soaked in water and unfleshed, and broken up in the ordinary manner. The patentee then takes 6 lbs. of soda ash, pearl-ash, potash, or any other strong alkali, and 6 lbs. of unslaked lime, and boils them in six gallons of water. He then adds to this mixture sufficient water to reduce the strength of the solution to 14° Twaddle's Alkali Hydrometer, and immerses the skins, handling them well at first, so as to expose to the solution every part of their surface. The skins are allowed to remain in the mixture until the hair starts at every part, when it is removed with knives, and the skins are then worked out in clear water, as is ordinarily practised by tanners.

2. *Sheep Skins.*—To remove the wool from sheep skins, the patentee applies with a white-washing brush to the flesh-side some of the above solution. In about two hours, the solution will have caused the wool to start, when it is removed with knives, and the skins are then well worked out, as customary. This process effects a considerable saving of time over the system of limes at present adopted in the trade.

3. *The Bait.*—Instead of using hens and pigeons' dung, the patentee makes the bait by mixing with water a sufficient quantity of sulphuric acid to give it a perceptibly acid taste. The skins are immersed in this liquor, and will generally run down in an hour or two, but if they should not run down fast enough, more acid must be added, and the skins are then to be well worked out in clean water. The acid is subsequently neutralised with stale urine, and the skins are again well washed.

4. *Tanning the Skins.*—For this purpose the patentee takes, for 100 calf skins, 100 lbs. sumach, 50 lbs. terra japonica, 12½ lbs. sulphate of potash, and 12½ lbs. alum, which he boils for half an hour in sufficient water to cover the skins. He then

macerates in cold water 40 lbs. oak bark, which he adds to the above mixture, and immerses the skins therein, handling them well at first, and continuing to do so until the skins are found to be tanned, which will generally be in about six or eight days. The quantity of liquor above mentioned is sufficient for twenty cows, oxen, or horses' hides, and for a hundred sheeps, calves, or other skins.

5. *The Grain.*—The grain must be laid with weak liquor of the kind last described.

***Claims.*—The improvements described in unhairing and tanning hides and skins.**

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in the manufacture of coke, and in application of the gaseous products arising therefrom to useful purposes. (Being a communication.) February 23; six months.

William Stirling Lacon, of Great Yarmouth, Norfolk, gentleman, for improvements in the means of suspending ships' boats, and of lowering the same into the water. February 23; six months.

Samuel Banes, of Bethnal-green, Middlesex, master mariner, for certain improvements in apparatus to be applied to or connected with the cables of ships or other vessels when riding at anchor. February 23; six months.

Charles Cowper, of Southampton-buildings, Chancery-lane, Middlesex, for improvements in machinery for combing and preparing wool and other fibrous substances. (Being a communication.) February 23; six months.

Jean Theodore Coupier and Marie Amedée Charles Mellier, of Maidstone, Kent, gentlemen, for certain improvements in the manufacture of paper. February 23; six months.

Thomas Young Hall, of Newcastle-upon-Tyne, coal owner and colliery viewer, for improvements in screens for screening coal and other substances requiring to be screened. February 23; six months.

Richard Archibald Brooman, of the firm of J. C. Robertson and Co., of Fleet-street, London, patent-agent, for improvements in windmills. (Being a communication.) February 23; six months.

William Walker, of Plymouth, Devon, Commander in the Royal Navy, for a method or means of ascertaining and indicating the deviations or errors of the mariners' compass. February 23; six months.

James Pilling, of Rochdale, Lancaster, spinner and manufacturer, for certain improvements in looms for weaving. February 23; six months.

Peter Armand le Comte de Fontainemoreau, of South-street, Finsbury, London, for certain improvements in gas-burners. (Being a communication.) February 23; six months.

Alfred Charles Hobbs, of New York, America, engineer, for certain improvements in the construction of locks and other fastenings. February 23; six months.

Thomas Walker, of Birmingham, for improvements in steam engines. February 23; six months.

Samuel Boulton, of Manchester, agent, for improvements in the treatment of metallic ores, and certain salts and residuary matters, and in obtaining products therefrom. February 23; six months.

Henry Bessemer, of Baxter-house, Old St. Pancras-road, Middlesex, for improvements in expressing saccharine fluids, and in the manufacture, refining, and treating sugar. February 24; six months.

Russell Sturgis, of Bishopsgate-street, London, merchant, for improvements in weaving looms. (Being a communication.) February 25; six months.

John Elce, of Manchester, Lancaster, machinist, and John Bond, of Burnley, in the said county, machinist, for certain improvements in machinery, for preparing cotton and other fibrous substances; also in machinery or apparatus applicable to looms for weaving, and the tools employed therein. February 26; six months.

LIST OF SCOTCH PATENTS FROM 22ND OF JANUARY 22ND, TO FEBRUARY 22, 1852.

Aime Nicholas Derode, of Rue St. Roch, Paris, France, gentleman, for a certain process of uniting cast iron to cast iron, and to other metals, and for uniting other metals together. January 26; four months.

George Torr, of the chemical works, Turnley's-lane, Rotherhithe, animal charcoal burner, for improvemens in burning animal charcoal. January 26; six months.

James Pillans Wilson, and George Furgusson Wilson, of Wandsworth, Surrey, gentlemen, for improvements in the preparation of wool for the manufacture of woollen and other fabrics, and in the process of obtaining materials to be used for that purpose. January 26; six months.

Victor Lemoing, of Cette, Department of l'Herault, France, for certain improvements in rotary engines. January 26; six months.

John Stopporton, of the Isle of Man, engineer, for certain improvements in propelling vessels, parts of which improvements are applicable to steam engines and pumps. January 28; six months.

Joseph Stenson, of Northampton, engineer and iron manufacturer, for improvements in the manufacture of iron, and in the steam apparatus used therein, part or parts of which are also applicable to evaporative and motive purposes. January 30; six months.

John Chatterton, of Birmingham, Warwick, agent, for certain improvements in protecting insulated electro-telegraphic wires, and in the methods and machinery used for that purpose. January 30; six months.

Sidney Smith, of Nottingham, for improvements in indicating the height of water in steam boilers. February 4; six months.

Francis Clark Monatis, of Earlston, Berwick, builder, for an improved hydraulic syphon. February 4; six months.

George Duncan, of the New North-road, Hoxton, and Arthur Hutton, of the same place, for improvements in the manufacture of casks. February 6; six months.

George Collier, of Halifax, York, mechanic, for improvements in the manufacture of carpets and other fabrics. February 10; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the manufacture of pigment or paint, February 11; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in machinery for weaving coach-lace, Brussels tapestry, and velvet carpeting, and other pile fabrics. February 13; six months.

James Anderson Young, of Buchanan-street, Glasgow, North Britain, surgeon dentist, for certain improvements in dental operation, and in apparatus or instruments to be used therein. February 16; six months.

Charles Cowper, of Southampton-buildings, Chancery-lane, Middlesex, for improvements in machi-

nery for combing and preparing wool and other fibrous substances. February 13; six months.

Hermann Turck, of Broad-street-buildings, in the City of London, merchant, for improvements in the manufacture of resin oil. February 18; six months.

James Roberton, of Oxford-street, Manchester, chemist, for improved methods of producing or obtaining printing dyes and other substances, which improvements, in whole or in part, are applicable to other like useful purposes. February 20; six months.

LIST OF IRISH PATENTS FROM THE 21ST OF JANUARY TO THE 19TH OF FEBRUARY, 1852.

Edwin Rose, of Manchester, Lancaster, Esq., for certain improvements in boilers for generating steam. February 6.

Frederick Rosenborg, of the Albany, Middlesex, Esq., for improvements in the manufacture of casks, barrels, and other like articles, and the machinery employed therein. February 10.

John Livesey, of New Lenton, Nottingham, draughtsman, for improvements in the manufacture of textile fabrics, and in machinery for producing the same. February 10.

Alexander Hediard, of Rue Taitbout, Paris, gentleman, for improvements in propelling and navigating ships, boats, and vessels by steam and other motive power. February 10.

Charles James Pownall, of Addison-road, Middlesex, gentleman, for improvements in the preparation and treatment of flax, and other like fibrous vegetable substances. February 11.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Feb. 20	3129	J. Keable	Lambourn	Guard frame for pig trough.
,,	3130	J. Jones and Co.	Sheffield	Galoshes for sheep and other cloven-footed animals.
21	3131	G. Murrell	Chelsea	Anti-mephitical ventilator, or vapour dispeller.
,,	3132	J. H. Noone, and W. Exall	Camden Town	Spring-carriage head.
23	3133	Brown and Redpath	Commercial-road	Apparatus for lowering boats from ships or other vessels.
,,	3134	J. Smith	Coven, near Wolverhampton	Boiler.
24	3135	J. Purdey	Oxford-street	Self-expanding bullet.
,,	3136	J. H. Cutler	Birmingham	Pearl buttons.
,,	3137	W. Woolford	Bradford, York	Seating of singe plates for singeing fabrics.
25	3138	Brown, Marshall & Co.	Birmingham	Railway carriage.
,,	3139	R. Best	Birmingham	Reflector.
,,	3140	W. Proger	Newport, Monmouth	Safety and signal lantern.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

Feb. 26	366	W. Eassie	Gloucester	Pole and bolster for railway and other trucks.
,,	367	J. Thomson	Old Kent-road	Syphon gas-stove.

Errata.

Page 144, column 2, after the words "exactly parallel to the line cut on the barrel;" insert "fit in the sliding piece."

The Electric Telegraph in Piedmont.—The correspondent who supplied us with the article on this subject (*ante*, p. 98), wishes us to state that the communication was *original*, and not, as represented, taken from the *Gazzetta Piemontese*. The error arose from a misconception of the meaning of a private note which accompanied the paper.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburg.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1491.] SATURDAY, MARCH 6, 1852. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

WHITELAW'S PATENT IMPROVEMENTS IM STEAM ENGINES.

Fig. 17.

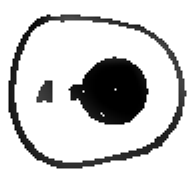


Fig. 16.

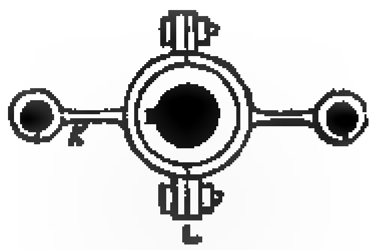


Fig. 18.

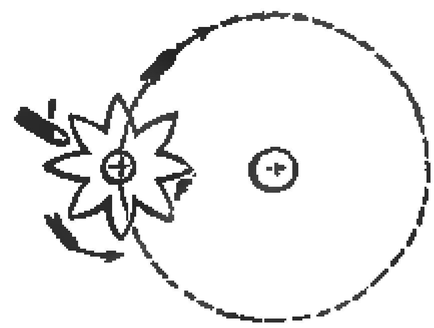


Fig. 3.

WHITELAW'S PATENT IMPROVEMENTS IN STEAM ENGINES.

We now lay before our readers a full description of those portions of Mr. Whitelaw's improvements which he considers to be of the greatest practical importance, extracted from his specification enrolled 31st January, 1852, the claims of which we have already given. (See *ante*, p. 135.)

Specification.

Figure 3 represents an elevation of an improved engine adapted for a screw steamer. In this arrangement the cylinder A is placed on one side of the vessel, and the piston rod is connected by links to the end B of the working beam. This beam, in place of being set to work upon a centre equidistant from each end of the beam, is carried on the centre C, placed considerably nearer to the centre line of the cylinder than to the connecting rod centre. In this example, the distance from B to C, the respective centres of the piston rod connection, and the main centre of the beam, is one half that comprehended between C and D, the main centre, and the connecting rod centre. In this way the engine has a short stroke, and therefore admits of being worked at such correspondingly high speed as may be required to drive the shaft of the screw propeller directly, or without spur wheels or other intermediate gearing, at the same time that the reduced pressure on the crank, and its increased length, give to this engine most of the advantages of one of the ordinary kind having a length of stroke even greater than that corresponding to the length of crank in this improved engine. In addition to these important points, the engine is cheaper in construction, lighter, and occupies less room than the ordinary engine. In this kind of engine the cylinders, instead of being side by side, may be set one on each side of the vessel, so as to balance each other.

Fig. 10 is a diagram of a horizontal cylinder engine, arranged to work so as to receive the advantages of the differential or unequally-divided beam. The cylinder A has its piston rod connected by a link at B, nearly at the middle of the length of a lever or beam CD, which works on a fixed centre at C. In this way the end D of the beam, by having a traverse of about double that of the piston, actuates the long crank E by means of the connecting rod F. The other end of the beam may be made available for actuating a pump by an extending arm or lever G, as shown in the drawing.

On referring back to fig. 3, it will be observed that if the slide valve were placed either on one side or behind, instead of in front of the cylinder, as therein represented, the cylinder might be placed much lower down: this would admit of the working beam being also lowered, provided a sufficiently long connecting rod could still be obtained.

Fig. 12 is a diagram of a pair of vertical cylinder engines, with working beams brought very close down towards the crank shaft. The cylinders A are fitted up on the "trunk" principle—that is, with hollow trunks or rods B attached to the upper sides of the pistons, and working through stuffing boxes in the cylinder covers, like the ordinary piston rods. The pistons are jointed, as shown at C, to the lower ends of links D, which work inside of the trunks B, and are jointed by their upper ends at E to the short ends of the working beams, carried on main centres at F. The opposite long ends of these beams are jointed at G to the lower ends of the links or short lengths of connecting rods H, which are again connected by joints at I to the upper ends of the main lengths J of the connecting rods. The latter, passing downwards, are jointed at their lower ends to their respective crank pins K of the main shaft L. In this instance, the short links H add, in reality, so much more effective length to the main connecting rods J; in other terms, the effective length of the connecting rods is equal to the whole length from G, at the extremity of the long end of the working beam, to K at the crank pin. The upper ends of the links H are therefore not guided in a vertical direction, but each beam is made to act as a guide to the connecting rod of the other by means of the rocking levers M, fastened on the main centres. The upper end of these levers are jointed to links N, the opposite ends of which are similarly connected at I to the joints in the connecting rods G, I, K. By this means the action of each beam guides the connecting rod of the opposite beam, retaining the centres I at the proper effective angle for working; that is, the centres I are so guided as to work nearly in the same curve, through which a point at this distance from the upper end, measured along a straight inflexible rod of the length G, I, K, would work, so as to give the jointed rod the full working advantage of a straight inflexible rod of about the same length. The rods O, depending from the working beams, may work air or cold water pumps.

Fig. 13 is a diagram of a Woolf's, or double-cylinder expansion engine, arranged according to my improvements. In this plan A is the main centre of the working beam, on each side of which centre, and at suitable distances asunder, are placed the small or high pres-

sure cylinder B and larger or low-pressure cylinder C, their respective piston rods being connected to the main beam at D and E. From the end F of the working beam the connecting rod descends to the crank-pin G below. It is obvious that, by this arrangement, the united effect of the pressure of the steam on the two short-stroke pistons is made to act upon a long crank, as in the plans which I have before described. The action of the pressure of the steam on each piston is also balanced on each side the main centre. The steam ways communicating between the cylinders are straighter than in the ordinary Woolf's engine, inasmuch as the steam from the upper end of the small cylinder passes directly into the corresponding upper end of the large one, and similarly the exhaust, at the opposite ends, is from the lower port of the small cylinder to the corresponding port of the large one, and one cylinder being placed near the other, the connecting steam passages are shorter than they are in other engines of this class; where it is desirable to avoid the use of cylinders of very large diameter, two short cylinders of small diameter, and each fitted with a piston, may be erected one upon the other, to work with one piston-rod. The effect of a strong stroke of piston, with a long crank, may be secured by placing the cylinder between the main centre and the connecting-rod end of the beam. This arrangement is capable of easy illustration in fig. 13, whereby, on removing the small cylinder B and the short end of the beam, the cylinder C will act upon the main beam, as upon a lever of the third order, giving the connecting-rod end F the required amount of stroke upon the same principle as that of fig. 10. It will also be obvious that the arrangement shown in fig. 13 may be modified by transposing the relative positions of the large and small cylinders, the small cylinder being placed on the connecting-rod side of the main centre.

Fig. 12.

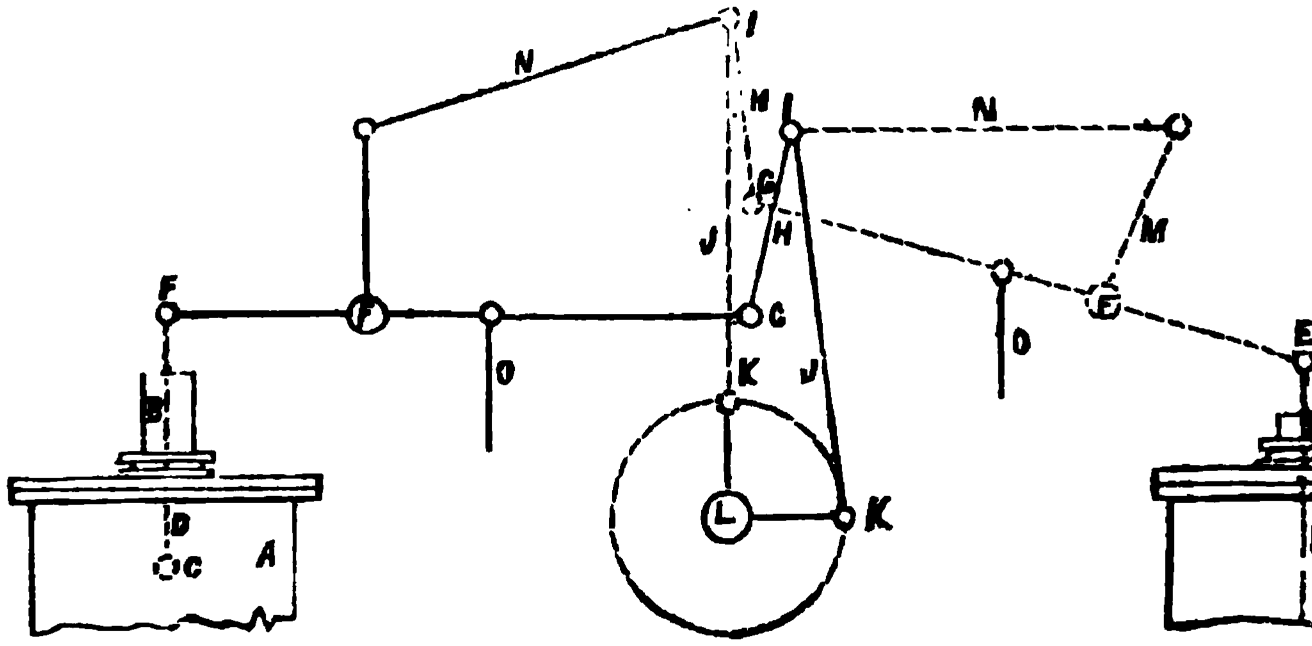


Fig. 14 is a complete side-elevation of one form of governor with its regulating mechanism attached. Fig. 15 is a vertical section through a portion of the governor spindle, and part of the slide mechanism. Fig. 16 is a horizontal section of the spindle with a plan of the lower sliding cross-head. Fig. 17 is a plan of the expansion cam; and fig. 18 is a diagram representing the pair of adjusting star-wheels, with two of their fixed detents. The cam A, for working the expansion-valve, is carried round by a spiral feather B on the lower end of the governor-spindle, and has a long boss C fitting loosely to the spindle, and passing upwards for connection with the pendulum action above. Then, as the pendulum balls expand with the increased rate of the engine, they draw the cam upwards, thus traversing it along its spiral feather B, and setting it forward to cut off the steam earlier. Similarly, the pendulum action brings down the cam again, as the balls contract on the diminution of the engine's speed, and thus the cam is set back. In this way the upward or downward traverse of the sliding tube D of the governor, causes the cam A to be set forward or back, as the case may be, on its spindle, thus altering the extent of expansion. The lower end of the tubular slide D, which fits loosely on the upright spindle, and is linked in the usual way to the pendulous arms above, is formed with a cross-head E, having an eye at each end, bored out, to receive the vertical spindles of the star-wheels F, which are carried round with the governor spindle. On the two fixed brackets G, set on opposite sides of the governor spindle, are fixed two sets of stationary pins or teeth, H and I, each pair being in the same place, and when the engine is working at its proper rate, the star-wheels F revolve with the spindle of the governor, at such a height as to work clear of the fixed teeth H and I; but should the engine increase its speed, the interior portions of the peripheries of the star-wheels F will come in contact with the inner and higher pair of pins H. When this

occurs, the revolution of the star wheels, with the governor spindle, will cause them to turn upon their own individual axes; and if the governor revolves, as indicated by the arrow in fig. 14, this action will also cause the star wheels to turn in the direction indicated by the arrows upon them. If, on the other hand, the engine's speed should decrease, with the governor spindle still going in the same direction, then the exterior part of the periphery of the star wheels will similarly come in contact with the outer pins I of the brackets G (as represented in the diagram, fig. 13), when the star wheels will be turned in the opposite direction, as pointed out by the arrows in that figure. These two opposite actions, then, of the star wheels are made available for securing an additional power or secondary action of regulating the speed of the engine through its expansion valves, by means of the vertical spindles J, on the upper ends of which the star wheels are fast. These spindles are screwed at their lower ends, and are passed through screwed eyes in the cross-head K, attached to the upper end of the boss of the cam A. This cross head fits loosely in a ring groove in the cam boss, and carries a side projecting piece L, which works into a short groove in the governor spindle, and this serves as a vertical guide for the cross-head during its traverse up or down, whilst the cam-boss works round within its collar. Similarly the vertical traverse of the tubular slide D of the governor is insured by a cotter or flat stud passed through the governor spindle, projecting on each side through a vertical slot in the slide.

Fig. 14.

Fig. 10.

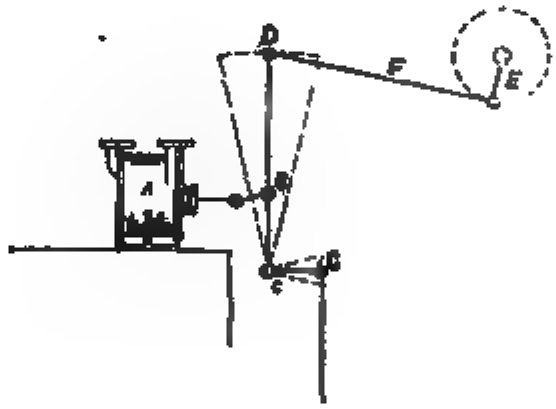
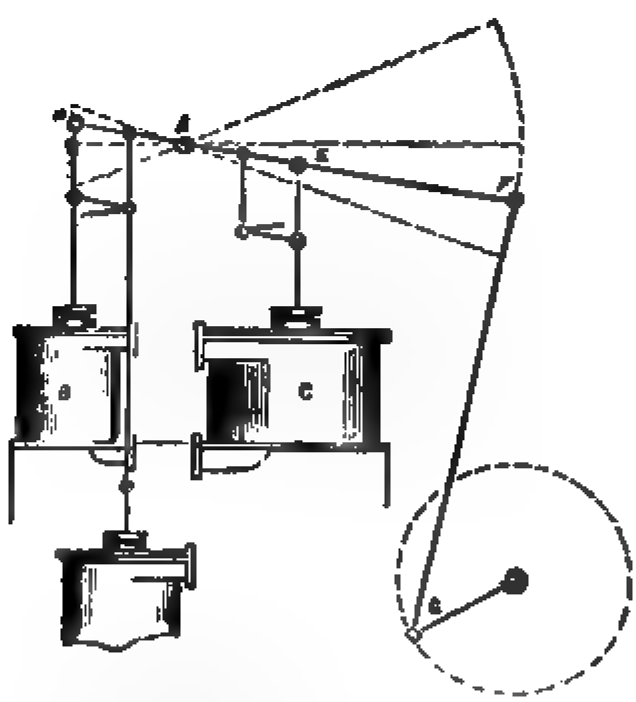


Fig. 13.



By the adoption of this arrangement, as the expansion cam A has a partial turn communicated to it in either direction by the upward or downward traverse of the governor-slide D, the star wheels F also get a partial revolution correspondingly as they come in contact

with one or other of the two pairs of fixed pins H I, and thus what I term a secondary action is given to the cam, setting it still further forward or backward by the revolution of the screwed spindles J, through the eyes of the cross-head K. And this additional or secondary action will go on, until the gradual arrival of the engine at its true rate of working shall bring the star wheel between, and clear of the fixed teeth H I. By this means, if the engine is exposed to varying degrees of resistance, this additional movement will give it a greater nicety of adjustment, and keep it at a more uniform rate than it were unfurnished with such secondary action.

By a slight addition to the mechanism, provision is made for the prevention of the accidental turning of the spindles of the wheels F too far in either direction. The wheels are attached to their spindles by stiff friction, and the eyes of the cross-head K are furnished with inclined teeth or detents on each side, corresponding to similar teeth, set in reverse directions on the lower and upper sides of the upper and lower collars M N fast on the spindles. Thus, when the spindles have turned to the full extent allotted to them in either direction, these catches will come into action and prevent further movement, whilst the stiff friction-connection of the wheels on their spindles will allow the wheels themselves to turn or move free when brought in contact with the fixed teeth H I. By a slight modification of this arrangement, one of the star wheels may be dispensed with, a spur pinion being placed on one of the spindles, as at O, to gear with the loose pinion P on the governor spindle, which pinion again gears with the third pinion Q fast on the opposite star-wheel spindle. In this way the revolution of one star-wheel spindle is communicated to the other to give both a simultaneous movement, whilst one star wheel only is used. Or the three pinions O, P, Q, may still be used even with two star wheels, in order to insure the simultaneous movement of the two spindles, in case one wheel should at any time come into action before the other.

Instead of having merely two pairs of fixed pins H I, three or more pairs may be used, and set at different heights, in order that, when the engine's rate is only slightly faster or slower than it ought to be, the secondary action may come into play with greater delicacy. The same effect may also be produced by two pairs of pins, as shown in fig. 14.

In engines working at a high velocity, where it might be injudicious to work the governor spindle at the rate necessary for the ordinary single cam, as in fig. 17, the governor may be reduced in speed if fitted with a cam made double or triple to correspond in this reduction in the rate. Or, instead of having the cam upon the governor spindle itself, it may be carried on a separate spindle working in connection with the engine, and, if adapted to that spindle in the same way as the cam A is connected to the governor spindle in fig. 14, the cam may be moved backwards or forwards, as required, by means of a lever or other connection with the governor. And the secondary action may also, in this case, be applied so that the cam, if placed on a separate spindle, may be made to regulate the speed to as great a degree of nicety as if it were placed on the governor spindle. And although I have herein described the apparatus as applied to actuate a cam fitted on a spiral feather, it is obvious that it may be adapted to work a tapering cam or other apparatus, such as "Field's valve," where the cam is simply traversed along in the direction of the axis of the spindle on which it is carried.

ON THE LONGITUDE OF PLACES, AND ON THE APPLICATION OF THE ELECTRIC TELEGRAPH TO DETERMINE IT.

To a maritime country like Great Britain, it is of high importance that the exact latitudes and longitudes of different places, particularly on the coast, should be ascertained. One of the attendant advantages is, that if a ship begins its voyage from such place, the commencement of its course is a fixed point, and the beginning of its reckoning accurate. The latitude of a place can be easily determined by well-known methods: to find its longitude, however, or the difference between its longitude and that of a known meridian, is a problem of greater difficulty. There are several modes of practically determining it; still, the methods chiefly depend on geodetic admeasurements or on astronomical observations. In determining the longitude of a place by the geodetical method, it is assumed that the earth is an exact spheroid, the axes of which are known, and that the earth's figure is perfectly regular: the discrepancies which have been found in different meridian arcs, prove that this latter assumption is not founded on fact, and that, therefore, it may be an element

of error in the longitude of a place so determined. In several of the astronomical methods, the figure of the earth does not enter into the process; and the difference of longitude between two places is ascertained with equal exactness whether that figure be regular or irregular. Those methods depend principally on the difference of apparent time between the two places: a difference of *four minutes* in time gives one degree of longitude. Hence, perhaps, the simplest mode of solving this important problem, is by chronometers. It is supposed that a brief discussion on the practical application of the method may be interesting to some of the readers of this Magazine, especially as it has not found its way, it is believed, into any elementary treatise on astronomy published in this country.

The method is simply this:—Let a chronometer, well regulated, be set to a known meridian—for instance, that of Greenwich; then, if that chronometer be carried to a different meridian, it will continue to show Greenwich time, and therefore, if the time at this latter meridian be accurately determined, the difference between the time so ascertained and that shown by the chronometer will indicate the difference of longitude of the place of observation in time, which, converted into degrees, at the rate of 15° to an hour, will show the longitude from Greenwich.

For example; suppose the time by the chronometer is 6h. 19m., and the time ascertained at the place of observation is 9h. 23m., the difference is 3h. 4m., which, converted into degrees at the above rate, gives 46° of longitude, and, because the time of the place of observation is *before* that of Greenwich, its longitude is 46° *east* of Greenwich. [See "*Vince's Astronomy*," chap. 28, vol. i.] This method, at first sight, appears to be as easy to accomplish as it is simple in theory: in practice, however, difficulties occur which must not be overlooked. All chronometers are subject to some variation; their errors and daily rate must, therefore, be determined and duly considered in deducing the result: but the errors and uncertainty which attach to one chronometer are almost entirely cleared off by the employment of several. [This subject is well treated in "*Woodhouse's Astronomy*."] The method, it is supposed, has been practically applied in England by only two astronomers. In 1822 and 1823, Dr. Tiarks, previously known by his works in America, in delineating the boundary between the frontier of the United States and the English territories, was employed by the Board of Longitude to determine the difference of longitude between the Island of Madeira and Falmouth, and also the differences between Falmouth and Portsmouth, and Falmouth and Dover. Dr. Tiarks published an account of the proceedings to determine these points in the *Philosophical Transactions* for 1824. A Report on Chronometrical Observations, made in 1823, with a view to ascertain the differences of longitude between Dover and Falmouth and Falmouth and Portsmouth, has also been published separately, and may be had at Murray's. It appears from the Report, that *twenty-five* chronometers were employed: they were carefully placed on board ship, and never removed during the whole time of the expedition. The difference of each chronometer from the mean time of the respective places was carefully ascertained on different days, and this having been done, the differences of longitude between the places named was found by interpolating between the differences from mean time found at one place for every chronometer—a term corresponding to the time at which the differences of the chronometers from the mean time of the other places were ascertained, and subtracting such differences (corresponding to the same moment for the two places) from one another. The doctor says—"On the supposition of a nearly uniform rate of the chronometers, this interpolation may be performed by finding from any two observations only, at the same spot immediately following one another, an intermediate term by simple proportion. But if, on the contrary, it should be supposed that the rates of the chronometers increased or decreased with any kind of regularity, more accurate results would be obtained by employing all the observations of the same place to determine an intermediate term between the differences of the chronometers from the mean time of the place of observation. Three terms, thus used, would give a result correct to the second differences, and four times would give one correct to

the third differences. Supposing the differences from the mean time at the same place corresponding to the moments

t', t'', t''', t'''', to be d', d'', d''', d'''',

the difference corresponding to the moment t will be

$$\frac{(t-t'')(t-t''')(t-t'''')}{(t'-t'')(t'-t''')(t'-t'''')}.d'+$$
$$\frac{(t-t')(t-t''')(t-t'''')}{(t''-t')(t''-t''')(t''-t'''')}.d''+$$
$$\frac{(t-t')(t-t'')(t-t'''')}{(t'''-t')(t'''-t'')(t'''-t'''')}.d'''+$$
$$\frac{(t-t')(t-t'')(t-t''')}{(t''''-t')(t''''-t'')(t''''-t''')}.d''''.$$

From this expression the similar one for three or more terms may be derived." It has been inserted here, under the impression that it may be useful in other matters.

The result of these observations, with regard to the English stations, was, that the longitude of Falmouth is 4″ in time greater than it is laid down in the Trigonometrical Survey. It was also ascertained that the longitude of each of the other places, as determined by the chronometers, was greater in about the same proportion than that given by the survey. The doctor says — "We may, therefore, safely infer that it is a general and proportionate defect of all longitudes deduced from the survey, and not the erroneous longitude of any particular station, which has caused the disagreement between the results of the chronometers and of the survey. Supposing the final result determined by the chronometers to be correct, the increase of the longitude of the survey = 25′ 23″.5, is 4″.92, and at this rate all the longitudes contained in the account of the survey must therefore be increased."

Dr. Tiarks, having satisfied himself that there are errors in the longitudes of places in the survey, next enters into an investigation of the cause of the mistake; and he arrives at the conclusion that the longitudes laid down in the survey will deviate from the truth in the same proportion in which the parallels of latitude on a spheroid having the degree of the meridian in latitude 50° 41′ differ from those of the terrestrial spheroid, the compression of which is nearly $\frac{1}{300}$.

The longitude of the Cambridge Observatory was determined by chronometrical observations, in 1827, by the Astronomer Royal, who was then the Plumian Professor of Astronomy at Cambridge. He has published an interesting Memoir on the subject in the *Cambridge Philosophical Transactions*, vol. III. Professor Airy employed six chronometers, each of which was compared at a given hour with the transit clock at Greenwich; they were then taken to the Cambridge Observatory, and each at a given time compared with the transit clock of that Observatory; they were then taken to Greenwich, and a second time compared with the transit clock; they were then returned to Cambridge and similarly compared; they were sent again to Greenwhich, and a third time compared with the transit clock, which ended the observations. The chronometers in this case were compared with the clocks by the method of the coincidence of beats, which the Astronomer Royal thus explains: "The transit clock necessarily goes siderial time, very nearly; the chronometers were regulated to mean solar time. And as 365 solar days are equal to 366 sidereal days, the sidereal clock goes faster than a solar chronometer in the ratio of 366 : 365. Consequently, in one second of time, the sidereal clock gains on the solar chronometer $\frac{1}{365}$ of a second. If, then, the clock is behind the chronometer $\frac{1}{73}$th of a second, in four seconds it will beat exactly with the chronometer, and in four seconds more it will be $\frac{1}{73}$th of a second before the chronometer. During these eight seconds, the beat will strike the ear at so short an interval that no distinction of sounds is perceptible.

The business of the observer, therefore, in comparing a chronometer is to note down the time shown by both, at one of those seconds in which an interval of sound can be perceived. He must then wait till the sidereal clock has gained so much on the chronometer that another coincidence of beats can be observed.

Our chronometers beat five times in two solar seconds, and consequently the coincidence of beats took place at every alternate second for a short time. The next set of coincidences took place when the clock had gained one-fifth of a second on the chronometer, or at the end of about 73 seconds.

The accuracy of this mode of comparison can scarcely be imagined without trial. I think there is no doubt that a practised ear can determine the instant of coincidence with an error certainly not exceeding eight or nine seconds. This implies an error in the comparison not exceeding $\frac{1}{20}$th of a second. When three or more comparisons are made, and the mean taken, it is probable that the error seldom amounts to $\frac{1}{100}$th of a second.

I have cited this clear and practical exposition of the subject, because, notwithstanding its great utility, I am not aware that anything like it can be found in any treatise on astronomy, or other English publication. The following are the remaining principal steps in the process:

The time by the Greenwich clock, and the time by each chronometer at each comparison are tabulated, and the same thing is done with the comparisons at Cambridge.

The corresponding times of the Greenwich and the Cambridge transit clocks are set out. The error of each of the clocks upon sidereal times at the place to which it belongs was determined from observed transits, and clock's errors deduced from them; and ultimately, the time that the Cambridge clock was faster than the Greenwich sidereal time.

The longitude of the Cambridge Observatory was hence found to be 23″·54 east of Greenwich. The longitude, as deduced geodetically, was 24″·6 east of Greenwich, differing by 1″·06 or 16″ in space from that determined by the chronometer, which would imply an error of 300 yards.

From the result obtained in this case, the Astronomer Royal is of opinion that the hypothesis of perfect regularity in the earth's figure is erroneous to an amount far greater than the probable errors of observations. The above two cases, as before remarked, are the only ones, it is believed, in which chronometers have been employed to determine the longitude of places in this country. It would appear from the "Traité Elémentaire d'Astronomique Physique, par Biot," tom. iii., p. 375, that the method has been employed in other places. Biot says,

"Mais la dernière, et la plus complète, a été effectuée en 1843, par l'ordre du gouvernement Russe, sous la direction du célèbre astronome, F. G. W. Struve, pour déterminer la différence de longitude entre les observatoires de Greenwich, Lubeck, Altona, et celui de Pultowa, récemment érigé près de Petersburg avec le plus grand luxe scientifique, par la munificence de l'empereur de Russie, Nicolas 1er. Le choix des chronometres employés, et leur nombre fut proportioné à l'importance de la jonction astronomique qu'on voulait établir entre les deux points extrèmes, Pultowa et Greenwich. Ce nombre fut de soixante-huit, dont la marche a été admirable. On les comparait tous les jours entre eux, tant à bord que dans les points d'arrivage pour decouvrir leurs petites irregularités propres par leurs discordances occidentelles. Le transport et le retour entre les stations que l'on voulait rapporter l'une à l'autre, furent réitérés un grand nombre de fois. Les résultats de cette expédition remarquable ont été decrits, avec les plus grands details, dans des rapports faits par M. Struve à l'Académie de Petersburg, lesquels ont été publiés à Petersburg en 1844."

The Report adverted to may have found its way into some of the English publications, though I have seen no traces of it. The Czar's royal patronage of this and other scientific matters makes amends for many of his alleged shortcomings—it is a glorious example which other sovereigns, who would fain be considered less despotic and tyrannical, might, with great advantage to their country, follow. The munificent encourager of science can hardly be, at the same time, a deadly foe to rational liberty.

In the two cases which have been above discussed, it must be obvious that the labour of ascertaining the time at each place of observation, and the journeys to and from, must have made the operation toilsome to a high degree. Dr. Tiark's chronometers were transported from the one place to the other by ship —a mode of conveyance which, at first sight, one might suppose would be likely to affect the accuracy of the result. In the other case, the chronometers were sent from Greenwich to Cambridge, and *vice versâ* by a messenger on a coach. It speaks highly to the caution and practical foresight of all the parties concerned, when such accurate determinations were made under such casualties and difficulties.

The epoch is nearly arrived, it is hoped, when the same objects may be

attained without any risk or much trouble, when the exact time by the Greenwich transit clock may instantaneously be known at Cambridge or Falmouth; and also the times at these places, or the time at any other place in England, be as quickly made known at Greenwich. Of course the employment of the electric telegraph is alluded to. This surprising invention—perhaps the most astonishing one of this era of splendid discoveries—is, in fact, a mode of conveying intelligence which leaves thought itself behind in point of celerity. It has been already adopted by many of the railways. As a truly national advantage it ought, with as little delay as possible, to be generally associated with all railways. Government would act wisely were they to encourage its adoption in places which would hardly repay the necessary expense without such encouragement, so that information might be instantly transmitted from one part of the country to any other part if any incident required it. London and Plymouth will shortly be connected—hence, Plymouth, the intermediate towns, and the numerous other places which have already connected themselves with London, will be in instantaneous communication with each other. Cornwall, with its ports and interests, must not remain long isolated from the general advantage.

But although a considerable number of places have for some time been connected with each other and with London by electric telegraph, it is not commonly known that any extensive scientific object has been attempted to be accomplished by the instrumentality of the telegraph. In this respect, perhaps, America has the start of England. Our brethren on the other side of the Atlantic have applied the electric telegraph to test the occurrence of many astronomical phenomena—to determine the difference of longitude of various places at considerable distances from each other, &c, &c. Perhaps a sketch of the mode which the scientific men in America have adopted to render the electric telegraph practically useful in finding the difference of longitude of places may not be uninteresting to some of the readers of the *Mechanics' Magazine*. The subject has not received much discussion in our publications chiefly devoted to science, some remarks on the topic may therefore be serviceable—the mere relation of what has been done, possibly, may draw practical men's attention to the subject—they may suggest improvements, and even emulate to excell.

The first attempt to determine the difference of longitude by means of the electric telegraph was made by Captain Wilkes in 1844, between Washington and Baltimore. A chronometer, previously rated by astronomical observations in the vicinity, was taken to the telegraph-office of each place and compared together by the ear. This simple method would furnish the difference of longitude with greater precision probably than any mode then known. The difference of longitude of Washington, Philadelphia, and New Jersey, opposite New York, have been since ascertained with greater exactness. The following method was adopted for transmitting the telegraphic signals.

"A mean solar chronometer was compared by coincidence of beats with the sidereal transit clock before and after telegraphic signals. Then the party giving the signals, having previously broken the circuits, restored it by striking on his signal key, at intervals of every ten seconds for a period of about ten minutes, so as to insure at least one coincidence of beats. The party at the other station, who received the signals, was notified of each signal beat by hearing his own armature beat. The apparatus was adjusted so that the receiving armature beat should be nearly as loud as the clock beat. The times of the armature beat were compared with those of the receiving sidereal clock beat by the ear alone, and the time so recorded. On some nights, only twenty signals were given at intervals of ten seconds upon the sidereal clock. But this method only repeats on the receiving clock the same fraction of a second, and does not furnish the same precision as the method of coincidence of beats.

"It was found that signals could be given in coincidence with the clock beats with such precision that it was useless to attempt any correction of the signal times by the ear of the listener. But when the method of coincidence of beats of a mean solar and sidereal clock was dispensed with, and the fraction of

a second was required to be estimated entirely by the ear—the error in the estimates was quite appreciable. It was found that observers, on the average, estimate the fraction of a second too small when using the ear alone, unassisted by the eye. This error is greatest at the middle date between two clock beats, and was found to vary from 0·06 to 0·18 of a second with different observers. This plainly indicated the necessity of relying solely on the method of coincidences of a mean solar and sidereal clock or chronometer. It was found that, for the distance of 250 miles, embraced in these experiments, the electric current took no sensible time to propagate itself, and that two clocks at this distance could be compared with the same degree of precision as if they were placed side by side.

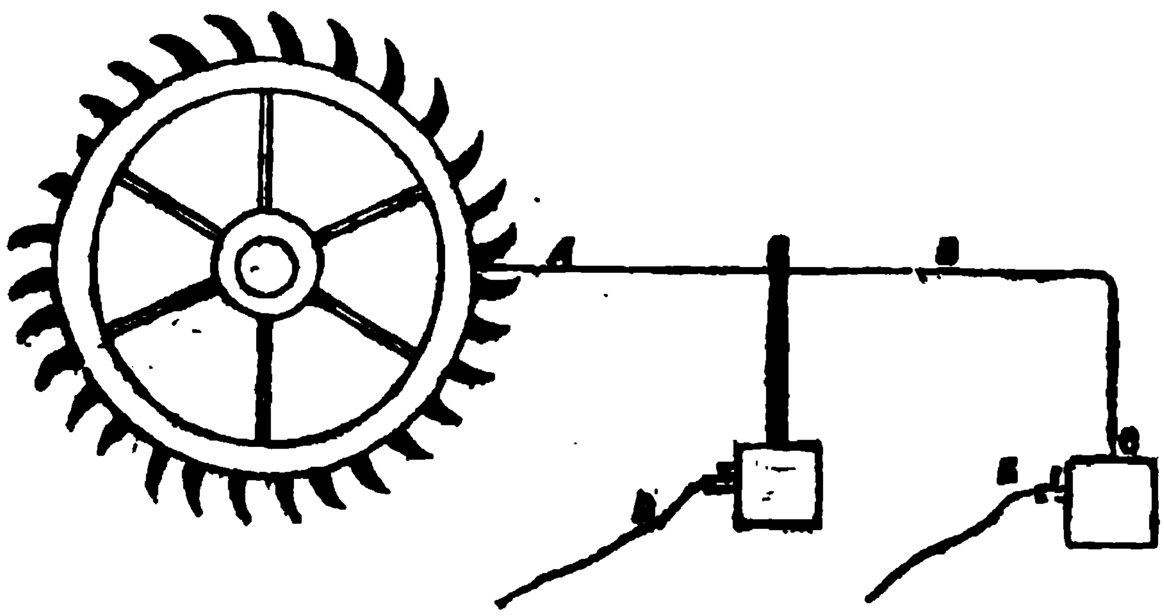
"The comparisons of time in some cases were made both by the method of coincidences and by telegraphing the transit of the same star over both meridians.

"The method of coincidences was practised in the following manner. The observer at Cambridge, Mr. Bond, with a solar chronometer before him, strikes the key of his register coincidently with the beat of his chronometer. The observer at New York, Professor Loomis, hears the click of his magnet and compares the instant with the beat of his own clock which indicates sidereal time. The two sounds probably do not exactly coincide; but the Cambridge observer, continuing to beat seconds upon the key of his register, the clicks heard at New York grow later and later as compared with the beats of the New York clock, and ultimately coincide. The New York observer records the instant of coincidence. The Cambridge observer *continues to beat seconds for fifteen minutes*, during which time the New York observer obtains two, or perhaps three coincidences of beats. The observer at New York now commences beating seconds in a similar manner coincidently with the ticking of his clock, and continues it for fifteen minutes. The Cambridge astronomer compares the click of his magnet with the beats of his chronometer, and during the fifteen minutes obtains four, and perhaps five coincidences—his chronometer beating half seconds. The comparison of the two time-keepers thus made is almost perfect. The other method of comparison was by telegraphing transits of stars. A list of zenith stars was selected beforehand, and furnished to each observer. The Cambridge astronomer points his telescope upon one of these stars as it is passing the meridian, and strikes the key of his register at the instant the star appears to coincide with the first wire of his transit. He makes a record of the time by his own chronometer, and the New York astronomer, hearing the click of his magnet, records the time by his own clock. As the star passes over the second wire of the transit instrument, the Cambridge astronomer again strikes the key of his register, and the time is recorded both at Cambridge and New York. The same operation is repeated for each of the other wires. The Cambridge astronomer now points his telescope upon the next star of the list, which culminates after an interval of five or six minutes, and telegraphs its transit in the same manner. In about twelve minutes from the former observation, the first star passes the meridian of New York, when the New York astronomer points his transit instrument upon the same star, and strikes the key of his register at the instant the star passes each wire of his transit. The times are recorded both at New York and Cambridge. The second star is telegraphed in a similar manner. The Cambridge astronomer now selects a second pair of stars, and repeats the same series of operations, and is followed by the astronomer at New York when the star comes upon his own meridian. By this comparison, the difference of time between the two stations is obtained independently of the tabular places of the stars."

The preceding account has been taken from the chapter on Electric Telegraphs, in Professor Loomis's interesting volume, entitled "The Recent Progress of Astronomy." The following description of a very considerable improvement and advancement of the method is extracted from the same chapter:

"In the course of the comparisons for longitude by telegraph which have been mentioned, many thousand signals were transmitted, and all by the hands of the human operator. But it is impossible for human fingers to move with the precision of machinery; and after the first successful trial of the tele-

graph for longitude, it became evident that an important advantage would be secured if the clock could be made to transmit its own signals. The desidera-



tum was, to make an astronomical clock break the galvanic circuit every second, so that, practically, it might be said that its beat could be heard along the entire line of telegraphic communication, and in such a manner as not to affect the rate of the clock.

"Dr. Locke, of Cincinnati, in the autumn of 1848, invented an attachment which may be applied to a *common clock*, and which fulfils every desirable requisite. He employs a reel, with sixty teeth attached to the axis of the escapement wheel. Each tooth, when horizontal, strikes against the handle of a platinum tilt-hammer, A B C, weighing about two grains, and knocks the hammer, which almost immediately falls to a state of rest on a bed of platinum. The fulcrum B, of the tilt-hammer, and the platinum bed rest severally on a small block of wood. Each is connected by wires D and E, with a pole of the galvanic circuit, and the circuit is alternately broken and completed by the rising and falling of the hammer. The latter operation takes about one-tenth of a second of time.

"This arrangement was first tested on the 17th of November, 1848, in the Cincinnati and Pittsburgh line, about 400 miles in length. The circuit was broken every second by the motion of the clock; and the fillet of paper being allowed to run off from the reel of the telegraphic register, it was graduated into equal portions, consisting of an indented line about nine-tenths of an inch in length, followed by a blank space of about one-tenth of an inch. The two correspond to one second of time, commencing with the beginning of the line. The appearance of the graduated paper was as follows

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"This experiment was continued for ten hours, during which time, the seconds by the Cincinnati clock were registered on the running fillet of paper at all the offices along the line. In order to distinguish the hours and minutes upon this graduated paper, Dr. Locke proposes to make the beginning of the ordinary minutes omit *one* blank space—the beginning of five minutes omit *two*, of ten minutes *three*, and of an hour, omit *four* consecutive blank spaces. Thus ordinary beginnings of minutes have continuous lines of *two* seconds, fives *three*, tens *four*, and hours *five* seconds.

"The mode of using the register for marking the date of any event, is to tap on a break circuit key simultaneously with the event. The beginning of the short blank space thus registered in the midst of the indented line of the register finds by a permanent printed record the date of the event. Thus A represents such a register printed upon the graduated paper.

A

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"In this arrangement, it is important that the fillet of paper should run off from the reel with entire uniformity. For this purpose more accurate clockwork is needed than is employed in ordinary telegraphing. One hundred inches of paper should be made to run off as nearly as possible in one hundred seconds of time. The friction of a second of any event recorded upon the paper may then

be determined with a proportionate scale, or dividers, within one or two hundredths of a second. This clock may be easily employed in registering transits of stars over the meridian. It is only necessary for the observer to tap on the key at the instant a star appears to pass each sine of his transit, and the observation is permanently recorded on paper with almost mathematical precision."

Professor Loomis says, hitherto in transit observations astronomers have been accustomed to estimate fractions of a second entirely by the ear, with only such assistance from the eye as can be derived from the rapid motion of the star through the field of the telescope. The error of such an observation, even with practical observers, frequently amounts to a quarter of a second. But in this new mode of observation, the observer has no use for his ears. The astronomer might in future be made without ears. It is only necessary for him to move his finger at the instant the star is seen to pass each wire of his telescope, and his observation is recorded in a permanent form, and may be subsequently examined at leisure. By using the method of imprinting the dates of bisections of these wires on paper when the use of the ear and the counting of beats, and the manual labour of writing down these dates, are all dispensed with; the equatorial intervals may be reduced from fifteen to two seconds, or even to one and a half. Thus the number of bisections in a single culmination of a star may be multiplied *seven fold*. The value of a night's work with the transit instrument is proportionally increased, so that a single year will furnish the same precision of results as many years of observation by the old method. By these experiments a difference in the registers of the papers, at several stations, was detected, which indicated a velocity of the electric wave, of about 19,000 miles per second. Professor Mitchel has deduced a velocity by a totally different process of about 28,000 miles per second.

Professor Loomis's book, from which so much has been taken, is a very interesting one, and is well worth a perusal. It affords memorable evidence of the manly vigour with which science is cultivated in America. Science is there encouraged by the Government, and its distinguished cultivators obtain their proper stations, and public esteem; and the consequence is, that the general welfare of the Republic is increased; the encouragement and distinctions which the States confer on men of science, reciprocally tend to the advantage of each party and the whole people is benefited, as well as enlightened by the policy. Whether our English rulers might not timely learn a useful lesson from the United States, as to the treatment of men devoted to science: whether the Americans, by the course that they pursue in that respect, are not fast going a-head of us, are questions which cannot be discussed here, however interesting and useful such a discussion might be. It is hoped, however, that the electric telegraph, with as little delay as possible, will be extended throughout this country, and be employed to determine, and to test the longitudes of different places. The sketch which has been given of the methods adopted by Dr. Tiarks and Professor Airy to determine the difference of longitude of places by chronometers will, it is supposed, by contrast, afford some proof of the advantages of the electric telegraph in ascertaining the same point.

The longitudes of places in England, given in almost all recently-published treatises have been taken from the results of the Trigonometrical Survey. It has been seen that Dr. Tiarks has come to the conclusion, that the longitudes so determined require a correction. It has also been observed that the Astronomer Royal makes the longitude of the Cambridge Observatory to differ from that ascertained by the Survey, which difference he ascribes to some peculiarity in the earth's figure; but it should be remarked, that Dr. Tiarks concludes that the longitudes in the Trigonometrical Survey are less than those found by chronometrical observations; whereas, Professor Airy has made the difference the other way; that is, the longitude of the Cambridge Observatory by the Survey is greater than that which he obtained by chronometrical observations. The Professor gives an opinion with regard to the discrepance between his result and that of the Survey; but he makes no remark on the difference of another kind, which Dr. Tiarks had found, and commented upon. I only name the fact: but upon the whole, I think it highly desir-

able, as well as likely to be generally useful, that the longitudes, not only of each of the places in England which have been referred to, but of all the principal ones determined by the Trigonometrical Survey should be tested by the application of the electric telegraph.

I think it requires no formal proof, after the preceding discussion, to show that, in addition to its ease and simplicity, the telegraphic method has greatly the advantage in point of accuracy over that of transporting chronometers from one place to another. So far as chronometers have been applied to test the longitude of places in England, the result has differed from that which was furnished by the Trigonometrical Survey. How may the difference be explained? Was there some fundamental error pervading the whole of the longitudes as determined by the Survey? Will the error discussed by Captain Kater, in the *Philosophical Transactions*, account for the discrepancies, or ought some other modifications on different meridians to be adopted, in order that the results may coincide? Probably these questions, and many others connected with the subject, may be answered more satisfactorily when a larger number of comparisons have been made; some general law may be the result. At present, the Cambridge case appears to disprove the law that Dr. Tiarks ennunciated.

By-and-by, when all the principal towns throughout this country are connected by electric telegraph with London, it may perhaps be hoped that Government will so far aid science as to carry on all the telegraphs to Greenwich, so that any facts having relation to science, or to astronomical phenomena, may be instantaneously conveyed to that institution, or from thence to any place in the kingdom. Should a general electric telegraph establishment be instituted at Greenwich, one great advantage would accrue from it, namely, all the public clocks throughout the kingdom could, if necessary, be regulated every day.

Much discussion has lately taken place in the *Times*, and other publications, with respect to having one time in every place in England: the subject has apparently, to some extent, been made a matter of the shop, and consequently, a very great deal of learned nonsense and profound twaddle has been produced on the topic. "*The-same-local-time-throughout-the-country-advocates*" argue, with considerable vehemence, that it is almost a common hardship that there should be a difference in time between London and Liverpool, or Land's-end. It may be so; but the difference in time has, up to this enlightened age, been the consequence of a difference of longitude; and the philosophers adverted to would have laid a more substantial foundation for their theory, if they had commenced by annihilating the difference of longitude. If they will set to work and establish one longitude for all places, I am quite certain that Exeter and all other places will not hesitate to adopt the "*one-local time*" doctrine. The question has been raised on this ground: The Railway Companies, at all the stations, no matter how far east or west from London, make their clocks show London time; a regulation which reflects very disparagingly on the scientific knowledge of these overbearing bodies, and which is exceedingly well adapted to create confusion throughout the country, without a shadow of benefit to any part of the community, except perhaps the saving a very little trouble to the railway officials. Yet the wiseacres who govern some municipal bodies—the zealous and servile worshippers of the railway dragons—have converted their clocks into a standing lie by making them their railway time.

Some time ago, under the influence of some incomprehensible hallucination, even Plymouth, one of the most enlightened and scientific places in the kingdom, adopted the "ONE-LOCAL-TIME" whimsey. It was soon found, however, that the tide would not heed the public clocks when they were made to show a lie. High water continued to observe the time of its occurrence as shown in the books—this differed from the clocks —and the difference occasioned so much confusion, that the clocks were soon made to indicate the old-fashioned time of the place. When a train starts ten minutes before a given hour at a station, or twelve minutes after, in accordance with London time—it is absurd to assert that the train is ever missed, because the town clock does not show railway time. Careless and stupid parties, no doubt, occasionally arrive too late; but they do so just as frequently at one sta-

tion as another—their movements are not regulated by clockwork. If the clocks at railways had two minute hands, the one showing London time, the other local—and were their time-tables constructed so as to agree with their clocks—all the confusion which they now so uselessly occasion would be effectually prevented. It is the overbearing of irresponsible confederation, and the insolence of all powerful monopolies, that lead railway companies to play their useless pranks with the time of places; the vagaries do them no credit; but it is really sickening to see corporate bodies such sycophant worshippers of railway despots as to make their clocks a standing lie, merely because it is in compliance with the whim of their divinities.

Since the preceding article was written, I have, with great pleasure, seen it announced in the newspapers that the Astronomer Royal is engaged in forming an Electric Telegraph establishment at Greenwich for many of the purposes adverted to. Such a truly national undertaking falls entirely, and most appropriately, within the Astronomer Royal's official duties, and there is no man in existence better qualified to devise such an institution—and to superintend its working, so that it may completely accomplish the objects aimed at—than he is. Under the Astronomer Royal's most efficient guidance, it may be hoped that England will hereafter make up for its lost ground in this unique application of the electric fluid.

DISIOTA.

Exeter, February 16, 1852.

MEMOIR OF THE LATE J. H. SWALE. BY T. T. WILKINSON, ESQ., F.R.A.S.

Part I.

John Henry Swale, the late distinguished geometer, was born at Bishopsthorpe, near York, on the 16th October, 1775. He received the rudiments of his education at some of the many respectable academies then established in Yorkshire, and after a successful course—during which his superior talents not unfrequently manifested themselves—he was engaged as assistant in a respectable establishment near Aberford. He subsequently appears to have filled similar situations at Chester and at Leeds, but was successful in obtaining the mastership of the Town School at Idle, near Bradford, some time about the year 1805. A private memorandum in one of his MSS. furnishes the information that he "*committed matrimony*" on the 8th of March, 1805, with Miss Sanderson, the daughter of one of his former employers; and MS. No. VI. records the birth of his two eldest children—E. S. Swale (1807), and J. H. Swale, jun. (1809), whilst resident at Idle. The same manuscript volume gives the birth of Mary Swale, his third child, at Liverpool, in 1810, to which place he had removed in the interval, and where he continued to reside until his death, in 1837.

His taste for mathematical investigations began to manifest itself at an early period; and before he was quite twenty years of age, he had began to correspond with the editors of the *Yorkshire Repository* and the *Scientific Receptacle*. Some of his earliest compositions most probably appear in these periodicals and in the *Geometrical Delights*, which are mostly dated from "Becca Lodge, near Aberford." Nor did he confine himself to mathematical speculations only, but took up various subjects in the philosophical and poetical departments, which he treated in such a manner as to evince that his course of reading was varied and extensive. His contributions to the latter classes of subjects, however, are but few compared with those on pure geometry communicated to different mathematical journals during the space of nearly forty years. Gifted as he was with a highly poetical temperament, and a just taste for the beauties of language, it might have been expected that more literary essays on general subjects would have emanated from his pen than have been preserved; but, as has been remarked by a valued friend who knew him well, "his character was of so retiring a nature, that if circumstances the most favourable to fame had surrounded him, he would have shrunk as it were into himself, in order to avoid the responsibilities inseparable from literary or scientific eminence." Besides, he seems to have pursued both literary and mathematical studies more as a *recreation* than as severe study, and hence many of his fugitive pieces were laid aside and forgotten almost as soon as completed.

Several of these, however, have been preserved in the different manuscript volumes he has left behind him, and relate to a variety of subjects, but do not seem to have been inserted with any regard to order. Probably the impulse of the moment may have led to their being copied from the scraps of paper on which they were originally written, and hence become interesting as the only existing relics of a more extensive collection. During the period of Mr. Swale's residence in Yorkshire, that county numbered amongst its private teachers some of the most eminent non-academic geometers of the last and present centuries Amongst these were Mr. John Ryley, afterwards editor of the *Leeds Correspondent;* Mr. Richard Nicholson, then of Leeds, but latterly of Liverpool; Mr. William Shepherd, of Bradford; and the *now* venerable Mr. John Whitley, to whom, in the ancient geometry, few countries can boast an equal. Mr. Swale formed a very early intimacy with Mr. Ryley, and from him, most probably, he first imbibed his ardent love for geometrical pursuits, as that gentleman already stood distinguished in this branch of mathematical research. In after life, these early intimacies were frequently referred to with his characteristic tenderness of recollection. "*By my early friend, Mr. Ryley,*" is annexed to some geometrical speculations bearing date—"30th August, 1828;" and, at their conclusion, the following tribute is paid to Mr. Ryley's memory:—"I linger among these problems and sketches, as the pleasing yet melancholy reminiscences of days for ever gone, and of an early acquaintance now silent and mouldering in the tomb!" His acquaintance with Mr. Nicholson commenced about the year 1795, when both were in active correspondence with several mathematical periodicals, and their friendship continued uninterrupted until the death of Mr. Nicholson, in 1811. Some years after (1820), Mr. Swale drew attention to the talents of his friend by reproposing in the *Leeds Correspondent* a locus from the *Mathematical Companion*, which he thought had been treated by the correspondents to that work with unmerited neglect. The locus forms Ques. 194 of the former work, and furnishes a beautiful specimen of geometrical investigation, conducted with all the elegance peculiar to Mr. Swale, who, besides *generalizing* the property, gives a short sketch of its previous failures as a reason why he now brings it "forward as a sincere tribute of friendship and respect for the memory of that ingenious geometrician."

Subsequently the "Prize Question" in the *Mathematical Companion* for 1800 is reconsidered by Mr. Swale, and as this had been proposed by Mr. Nicholson, his thoughts naturally reverted to their youthful intimacy; hence, at the close of the solution, which bears date "August 28th, 1828," he again bears testimony to the merits of his friend, whom he styles "My early mathematical associate, thirty-three years ago. We used to meet at Mr. Ryley's to converse on mathematics; but now they both (and many more) have long been in the grave. Alas, what a *shadow* is man!"

From a letter bearing date "August 26th, 1851," I find Mr. Swale formed an acquaintance with Mr. Whitley "in 1802 or 1803, at the house of Mr. John Ryley, at Leeds;" and Mr. Whitley adds, "I often saw him there afterwards, during the Midsummer and Christmas vacations." The union of so many kindred minds could not but be productive of some definite results; and to this early association with so many distinguished geometers we may reasonably attribute Mr. Swale's subsequent predilection for the study of the ancient forms of pure geometry to the exclusion of almost every other branch of mathematics. I was in hopes of being able to rescue from oblivion some of the correspondence which passed between the able mathematicians just enumerated; but Mr. Whitley informs me he has "lost the letters received by Mr. Swale," and Mr. J. H. Swale, jun., states (Sep. 13th, 1851,) that "the parcels of letters which [he] believed to be in existence, [he] cannot find, and [is] afraid they have been destroyed by an accidental fire some years ago." This is, indeed, a circumstance much to be regretted, since the following draught of a letter to Mr. Whitley, transcribed into vol. vi. of the MS. Remains, furnishes abundant grounds for supposing that Mr. Swale's correspondence possessed features of more than ordinary interest:

"Idle, 9th February, 1809.

"Dear Sir,—I have purposed for some time to trouble you with one of my

scrawls on some mathematical trifles which I do not *clearly* comprehend . . . . and would thank you to 'enlighten my understanding,' as the Prayer-book devoutly says. Ques. 29, [*Mathematical Companion*, 1809. To inscribe a triangle in a given circle, such that its sides may pass through three given points in a straight line given in position,] you must be aware has been repeatedly done. I do not mean to say that it can be done by no other method than what has already been adopted by geometricians; but we must allow that Mr. Lowry's *general* method of inscription (Ques. 210, *Repository*, New Series,) is sufficiently elegant. Yet I like attempts, in the solution of problems, upon *different* principles. I am fond of the plodding ancients on this account; they never laid aside the subject until they had completely exhausted it.

"*I have discovered a general method of inscribing polygons in a given circle, each side passing through a given point: it is also applicable to the ellipse. I thought of it long ago, but I had laid aside the inquiry, and had not your problem made its appearance I should most probably never have resumed it.* . . . . I am pleased with the twenty-third question . . . . . *harmonicals* upon which it depends present a wide and pleasing field to the geometer.

"Among other geometrical subjects, I have lately collected and considered several problems of the loci:—give me leave to present one to your notice, to which I should like to have your demonstration to compare with my own.

"*Locus.*—The lines RA, RB, and the point Q are given in position: the *given* line QC revolves round the point Q, and from the intersections A, B, of the line ACB (always drawn perpendicular to CQ) with the lines RA, RB, are drawn AQ, BQ; also CI, CL, perpendicular to AQ, BQ, making ID=IC; LK=LC; and joining D, A, K, B; required the *locus* of the intersection P, of the lines DA, KB.

"The enunciation you will excuse, provided you can comprehend me; we may sometimes dispense with elegance in familiar correspondence . . . . . A circle and a right line are given in position; can you determine a point, by a *direct* construction, in the periphery of the circle, from which a tangent being drawn—the segment of the tangent intercepted between the point of contact and the line shall be given in length? I add my sincere respects to an old friend; remaining ever

"Yours,

"To Mr. Whitley. "J. H. SWALE."

The portion in italics relating to Ques. 29 has a most important bearing upon the "Historical notices respecting an Ancient Problem," by the late Professor Davies, in the *third* volume of the *Mathematician*. Mr. Swale's paper on the "Inscription of Polygons in Circles" there referred to, did not appear until the publication of the second number of the *Apollonius* in 1824, but the preceding letter puts it beyond doubt that, in 1809, Mr. Swale was not only in possession of his method of inscription in the case of the circle, but also its extension to the conic sections. (See also Gaskin's "Geometrical Problems;" Appendix I.; and Pott's "Appendix" to his "Elements of Euclid.")

(*To be continued.*)

GASKIN'S "GEOMETRICAL CONSTRUCTION OF A CONIC SECTION," ETC., ETC.*

We have great pleasure in calling the attention of our mathematical readers to this new work of Mr. Gaskin, some of whose former books have already been noticed in this Journal. The author has long been known at Cambridge as a first-rate mathematician, and, indeed, one who has few equals in the department of pure mathematics. The present tract will be especially welcome to those of our non-academical readers who take an interest in algebraical geometry, and in the various methods which have been recently applied to its treatment. The contributors and readers of the *Ladies' and Gentleman's Diary*, the *Mathematician*, and the *Cambridge and Dublin Mathematical Journal*, are all familiar with the great use that has recently been made of the

* "The Geometrical Construction of a Conic Section subject to five conditions of passing through given Points and touching given straight Lines; deduced from the properties of Involution and Anharmonic Ratio, with a variety of General Properties of Curves of the Second Order. By the Rev. Thomas Gaskin, M.A. Cambridge."

doctrines of "Involution and Anharmonic Ratio" in establishing the already known properties of the conic sections by new processes, as well as in the investigation of fresh ones. Our late lamented friend, Professor Davies, was particularly distinguished in this class of inquiries; and we are glad to find his place so ably supplied by Mr. Gaskin.

The present work contains the following chapters:

Chapter 1, On "Involution and Anharmonic Ratio; Inscription of a Polygon in a Polygon, and of a Polygon in a Circle."

Chapter 2, "Properties of the Circle," "Poles of Similitude and Axes of Similitude," &c.

Chapter 3, On the Properties of the Conic Sections, "Poles and Polars;" "Points in Involution;" "Director of a Conic Section;" "Conjugate Triads;" "Properties of the Equilateral Hyperbola."

Chapter 4, On the Geometrical Construction of a Conic Section, under various conditions.

Appendix 1, treats of "The Inscription of a Polygon in a Conic Section, so that its n sides may pass through n given points."

Appendix 2, On "The Description of a Sphere cutting four given Spheres in given Angles," and a "Conjugate Quaternion."

This will give the mathematical reader a sufficient notion of the nature of the tract; and if he feels at all interested in these subjects, he will thank us for bringing the book under his notice.

SUBMARINE TELEGRAPH.

On Monday last, by permission of the Directors of the Submarine Telegraph between England and France, a series of interesting experiments were made by Mr. Reid, telegraph engineer, of University-street, London, for the purpose of testing a pair of double-needle instruments and two new batteries which he had constructed. One of these instruments was placed in the Company's office at Dover, and the other in the French office at Calais, with a battery to each. Two of the submarine wires were then connected with the instruments, and put in circuit with the batteries. The length of the submarine cable in the Channel is about 24 miles, and about five miles of land telegraph on each side, making, in round numbers, a circuit of 68 miles. The battery that was to work this distance formed a strong contrast to the present battery now in use, the length being only 4 inches by 1½ deep, and the weight 1 lb. 5 ozs., while the old common battery used on the lines is 36 inches long, 7½ inches wide, 8½ inches deep, and weighs 64 lbs. Some of the telegraph clerks in the office smiled incredulously when Mr. Reid connected the miniature battery with the instrument, but were surprised to find the signals to and from Dover and Calais quite equal to the signals they were receiving from their former batteries. The next experiment was for the purpose of testing an improvement in the double-needle instrument, and will require the utmost stretch of faith on the part of our readers to believe. It was as follows:—The miniature batteries were removed from the instruments on each side of the Channel, and a piece of zinc, three-fourths of an inch square, and a piece of silver to correspond, were then introduced into the mouth of the operator at the office in Dover, and instructions sent to do the same at Calais. The wires, attached to these pieces of metal were then connected with the instruments, and by this simple means, and by the simplest of all batteries, the telegraph clerks sent several messages to and fro from England to France. The next experiment was similar to this, only a larger piece of zinc and a larger piece of silver were introduced into the mouth of the operator. The result was an improvement of the signals. The next day, March 2, the experiments were repeated with the same success. The instruments with the miniature batteries transmitted all the commercial messages, price of stock, funds, &c., till 1 o'clock, when they were packed up and sent to London. It was thought that during these operations the miniature battery would become exhausted; on the reverse, it improved, and seemed perfectly to maintain its character. From these experiments we may conclude a new revolution is in progress with telegraphs and batteries. They will become more simple, more easy to understand, and will eventually not only become as familiar as household words, but familiar and useful as household servants.—*Times.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MARCH 3, 1852.

JAMES PALMER, of Paddington, artist. *For improvements in delineating objects,*

and in apparatus and materials for that purpose. Patent dated August 23, 1851.

The purpose of this invention is to furnish the means of producing drawings of all descriptions of objects in a much simpler and more perfect manner than is effected by the camera lucida, camera obscura, graphic telescope, and other instruments hitherto proposed for that purpose.

A plate of glass is mounted in a frame or easel, which is furnished with suitable adjustments for supporting the glass in a vertical position at any convenient height. On one side of the plate of glass, and at a distance of several inches from it, is fixed the frame of a pair of spectacles, which is also capable of adjustment in position. One of the apertures of the spectacle frame is closed by a plate or shutter. The operator applies his face to the spectacle frame, and looks with one eye through the glass at the object which he wishes to delineate, and he then traces over the outline of the object on the glass, with a pencil formed of a mixture of wax, soap, shellac, and lamp-black, which is capable of marking very distinctly on the smooth surface of the glass. In this way, an exact drawing of the object, in true perspective, is obtained with great facility. The spectacle frame preserves the position of the eye without interfering with freedom of vision. The instrument is very convenient, and its use is readily acquired, which can scarcely be affirmed of any of the instruments hitherto proposed for the purpose, as is shown by the very slight use which is made of such instruments.

The drawing on the glass is transferred to paper by tracing it, or by pressing a moistened sheet of paper upon it.

The same apparatus is used in a similar manner for drawing with an etching needle on a sheet of gelatine supported by the glass, or on a sheet of glass coated with gelatine. The drawings thus made may be printed from the gelatine as from a copper plate. To enable the gelatine to be used for printing on moistened paper without adhering to it, it is rendered insoluble by immersing it in a solution of alum, borax, and acetate of lead. Gelatine so prepared does not adhere to the paper, and may be immersed in cold or warm water without injury. The prints from the gelatine may be transferred to stone or zinc, and printed in the ordinary manner of lithographic printing. The invention is applicable to making drawings and engravings of buildings, machinery, landscapes, flowers, or any other stationary objects. For taking portraits, a rest is provided to keep the head of the person in a stationary position.

These drawings or delineations are necessarily smaller than the real objects, and their size may be varied by varying the relative distances of the glass, and the object from the eye of the spectator. When it is required to increase the size of the drawings, a drawing on glass or gelatine is placed in an instrument somewhat similar to a magic-lantern, by which a magnified image is thrown on a disc of glass ground on both sides. A sheet of gelatine is fixed on the back of the glass disc, and the magnified image traced upon it with the etching needle, or with the pencils above mentioned.

Claims.—1. The modes of constructing apparatus for delineating.

2. The mode of delineating objects in the apparatus, and with the pencils described.

3. The mode of delineating objects upon gelatine with the etching needle, and printing the delineations so made.

4. The mode of enlarging the delineations made as aforesaid.

5. The apparatus for enlarging the delineations.

6. The mode or modes of manufacturing insoluble gelatine.

JAMES EDWARD MCCONNELL, of Wolverton, Bucks, engineer. *For certain improvements in locomotive steam engines and railway axles, parts of which are applicable to stationary and marine steam engines.* Patent dated August 28, 1852.

Claims.—1. The constructing, forming and shaping of the pistons of steam engines of malleable iron or steel.

2. The construction of steam cylinders with their valve faces, steam and exhaust ports, steam chest and casings, and also their cylinder covers of wrought iron.

3. The construction of the several parts of steam engines, known under the names of valve rods, piston rods, and connecting rods, each of wrought iron, or malleable iron, or steel, tubular or hollow.

4. The supplying of atmospheric air to the fuel or flame after it has left the surface of the fire by means of tubular stays inserted in and adapted to the fire-box.

5. The indenting of locomotive boilers immediately over the crank axle.

6. The adaptation of an apparatus placed in the smoke box of a locomotive boiler for heating the water before it enters the boiler, both by the heated gases that pass through the smoke-box as well as by the exhaust steam.

7. The "steeling" of the journals of railway axles, and also the manufacture of hollow axles from lap-jointed tubes welded, rolled, and formed as described.

8. The manufacture of hollow railway axles, of increased thickness at certain parts,

from lap-welded tubes rolled and shaped as described.

9. The manufacture of solid iron axles encased with steel.

EDWARD CLARENCE SHEPARD, of Duke-street, gentleman. *For improvements in obtaining and applying motive power.* (A communication.) Patent dated Aug. 28, 1851.

Claim.—The employment, in locomotive and other power engines, of fly-wheels acting by their pressure or weight on driving shafts, in a peculiar manner exemplified and described.

THOMAS BROWN JORDAN, of Belvedere-road, Surrey, mechanical engineer. *For improvements in machinery for cutting, dressing, planing, and otherwise working slate, and also for framing and setting the same.* Patent dated August 28, 1851.

Claims.—1. In respect of certain cutting and dressing machinery firstly described, the peculiar aggregate combination of parts of which the same consists; that is to say, in so far as regards the employment of cutting discs, brought into rolling contact with the slates, in combination with the other parts, movements, contrivances, and appliances, all or any of them represented in the drawings, and also described.

2. Certain other cutting and shaping machinery represented and described, in respect of all those things which it possesses in common with the dressing and cutting machine first described and claimed, and in respect also of certain other arrangements by which the cutting discs are made to operate in both directions, or both forwards and backwards.

3. Another cutting and dressing machine, in respect of all those things which it possesses in common with the two other cutting and dressing machines before described and claimed, or either of them, and in respect also of those other arrangements by which it is particularly adapted to constant employment in cutting slates of one given size, and two sides of each slate at one and the same time.

4. A slate shaping machine, represented and described in so far as respects certain arrangements, whereby two, three, or four sides of each slate are cut at one and the same time, and by one movement of the machine.

5. A slate-planing machine, represented and described in so far as respects certain arrangements by which both sides of the slates are planed simultaneously, and the cutting action is performed vertically, or at such an angle of inclination as to allow the waste to pass away from the machine by its own gravity, and wholly separated from the finished slates.

6. A slate parting-machine, represented and described in so far as respects the rocking action given to the arc of cutters, and the arrangements by which each tooth is made to penetrate deeper into the slate than the cutter or tooth immediately preceeding it.

7. Four machines for framing school and other like slates, distinguished by the letters A, B, C, D, and respectively described: that is to say, each in so far as respects the peculiar combination of parts (partly new and partly old) of which it consists, and the whole in the order and sequence of their operations, whereby such slates are framed with greater dispatch, in a much better manner, and at much less cost than is now practicable by manual labour.

PIERRE ARMAND LECOMTE DE FONTAINEMOREAU, of South-street, Finsbury. *For certain improvements in apparatus for gas-lighting.* (A communication.) Patent dated August 28, 1851.

These improvements consist in applying to the chimneys of gas-burners certain apparatus by which the supply of air to the burner is so regulated as to obtain from a given volume of gas the greatest possible illuminating and heating effects.

The apparatus consists of a perforated metal or wire-cloth diaphragm, which is placed at the bottom of the chimney of the burner, and serves to produce a division of the up-current of air into minute streams, and a metal disc with a valve in the centre, which is sustained at a slight distance above the top of the chimney by means of projections, which rest on a ring of porcelain fitted to the top of the chimney-glass. The valve in the disc is operated by a thumb-screw, for the purpose of increasing at pleasure the area of opening.

Claim.—The construction of an apparatus for regulating the supply and action of air on the flame of gas-burners, whereby the illuminating power of the gas under a given volume of flame is increased, and a considerable economy in the consumption of gas is effected.

BENJAMIN HALLEWELL, of Leeds, wine-merchant. *For improvements in drying malt.* Patent dated September 4, 1851.

These improvements consist in the employment for drying malt of numerous jets of gas, alone or in combination with the use of steam.

The gas or steam pipes are placed alternately under the floor of the malt-house, which is constructed of perforated tiles, for the ready transmission of the heat, and the burners of the gas-pipes are placed on each side of the same, so as to play on the outside of the steam pipes, as well as against the under side of the perforated tiles. The advantage of using gas is, that it admits of

the heat applied being regulated with great nicety, and at the same time it prevents the condensation of the steam in passing through the steam pipes.

Claim.—The employment of numerous jets of gas, alone or combined with the use of steam, for drying malt.

Specification due, but not Enrolled.

William Johnson, of Millbank, Westminster, gentleman. *For improvements in ascertaining the weight of goods.* Patent dated August 28, 1851.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Charles Reeves, junior, of Birmingham, Warwick, manufacturer, for certain improvements in the manufacture of bayonets, swords, and other cutting instruments. February 27; six months.

Charles John Mare, of Blackwall, Middlesex, for improvements in constructing iron ships or vessels, and steam boilers. February 27; six months.

James Pilbrow, of Tottenham, Middlesex, civil engineer, for certain improvements in apparatus for supplying the inhabitants of towns and other places with water. March 3; six months.

George Leopold Ludwig Kufahl, of Christopher-street, Finsbury, London, engineer, for improvements in fire-arms. February 3; six months.

George Wilkinson, of Streatham-terrace, Shadwell, engineer, for improvements in ships and other vessels. February 4; six months.

Alfred Trueman, of Swansea, manager of copper smelting works, and John Cameron, of Loughor, chemist, for improvements in obtaining copper from ores. February 4; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Feb. 26	3141	R. W. Winfield	Birmingham	Curtain ring-hook.
„	3142	W. Soutter	Birmingham	Joint for copper and brass kettles and other vessels.
„	3143	C. N. May	Reading	Smoke preventer.
„	3144	J. Derrington and Co.	Manchester	Tap or cock.
„	3145	C. W. Lancaster	New Bond-street	Rifle ball.
„	3146	C. W. Lancaster	New Bond-street	Rifle ball.
„	3147	C. W. Lancaster	New Bond-street	Rifle ball.
„	3148	T. and S. Knight	Southwark	Improved boiler.
27	3149	Myers and Son	Birmingham	Universal India-rubber holder.
28	3150	W. Dodsworth	Bradford	Spool motion.
„	3151	A. Gatti and E. Prinet	Clerkenwell	Self-acting card-case.
„	3152	J. Parkinson	Bury, Lancaster	Cock.
„	3153	H. G. Fuller	Greenwich	Apparatus for making sail thimbles.
March 1	3154	T. Sullivan	Foot's-cray, Kent	Amphaton dandy roller.
„	3155	E. Evans	Brixton	Screw gas tongs, or wrench.
„	3156	H. Beckwith	Skinner-street, Snow-hill	Mould for hollow conical bullets.
„	3157	Parsons and Terrill	Caledonian-road	Cooking apparatus.
3	3158	The Grangemouth Coal Company	Grangemouth	Heating apparatus for hot-houses and green-houses, &c.
„	3159	B. M. Wilkins	Sutton, Coldfield	Running rein-bridle.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

Feb. 26	368	J. Weston and Co.	Noble-street, City	Le distingué.
„	369	J. G. Wilson	Chelsea	Epanalepsian advertizing vehicle.
27	370	L. Cecconi	Brewer-street, Golden-square	Self-acting tuning fork.
March 1	371	R. Kerry	Surrey	Invalid's exercising-chair.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London— Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburg.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1492.] SATURDAY, MARCH 13, 1852. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

MESSRS. T. AND J. KNIGHT'S IMPROVED BOILER.

Fig. 2.

Fig. 3.

Fig. 1.

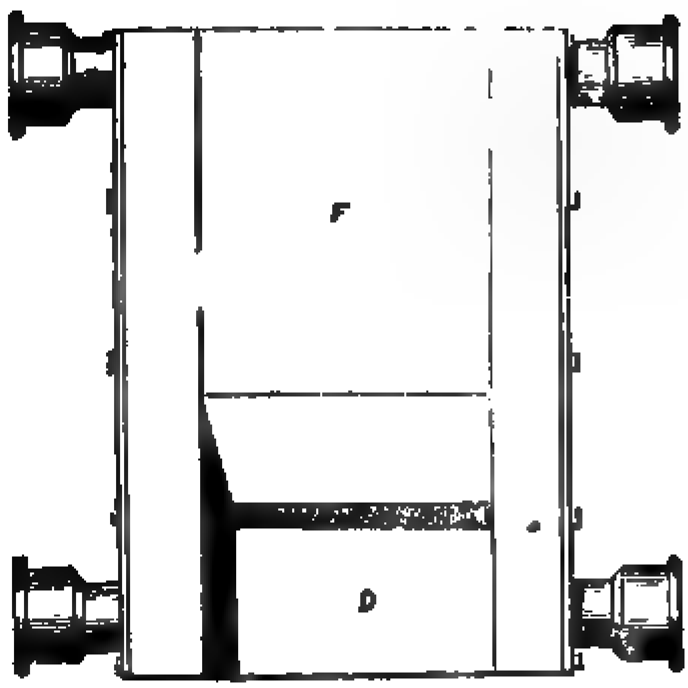


Fig. 4.

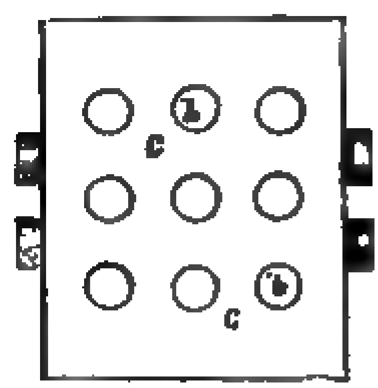


Fig. 5.

MESSRS. T. AND J. KNIGHT'S IMPROVED BOILER.

(Registered under the Act for the Protection of Articles of Utility. T. and J. Knight, of Great Suffolk-street, Southwark, Manufacturers, Proprietors.)

Description.

Fig. 1 represents a front elevation of this boiler. Fig. 2 is a section of it from front to back. Fig. 3 a section of the same from side to side. AA are water-spaces, which form the sides of boiler. BB cross-pipes, through which the side water-spaces communicate. C a water-space box, which forms the top of the boiler, and has outgoing pipes *aa* inserted into the sides, and also holes *bb*, for the emission of smoke. D a water-space box, which forms the back of the boiler, and communicates with the sides by the outgoing pipes *cc*. E a box similar to D, which is interposed between the cross-pipes, BB, and the coal-space G. F, plate which forms the front of the boiler. Fig. 4 ground plan of the box, which forms the top of the boiler; and fig. 5 a view of one of the pipes, BB, detached.

The purpose of utility contemplated by this design is the including in the smallest possible compass the greatest amount of heating power.

VICTUALLING OF THE NAVY.—PRESERVATION OF MEATS.

The recommendation of gelatine as an article of victual for the fleet was not to the exclusion of other kinds of diet; on the contrary, it was well known to Sir Samuel Bentham that to support health and strength in man, his food must contain an aggregate of all the several constituents of which the human frame is composed. Experience and experiment had already shown that neither gelatine nor sugar could alone sustain life, though both of them are highly nutritious when used in conjunction with other kinds of diet. In regard to sugar, for example, it was long ago known that negroes in Jamaica, at seasons when they indulged freely in sucking the sugar-cane, became extremely fat, and that sugar was largely used in the metropolis for fattening ruffs and rees; this gave rise to experiments more than thirty years ago: ruffs and rees were fed with sugar alone; all of them died of starvation. The subject has since been scientifically investigated by Liebig and others, and the need of furnishing these several constituents has been fully confirmed.

The primary consideration, then, in providing sea provisions is the due apportioning and furnishing the different elements essential to the upholding the human frame; information as to the particulars of them may be obtained in the works of Liebig, and other investigators of the subject.

Experience alone, has, however, sufficed to ascertain that salted meats produce disease, and that a mixture of vegetable with animal food is more or less essential, according as a climate is hot or cold; but the means of preserving animal substances without salt has not yet been scientifically investigated, nor practically exhibited in a manner to be depended on. Government would be amply recompensed for the expense of a series of exhaustive experiments on this particular, and in Government service there are means of verifying the length of time meat may be preserved which far exceed those possessed by private enterprise.

It is well known that oxygen is essential for the decomposition of both animal and vegetable matter; our grandmothers, and theirs before them, preserved gooseberries by placing bottles containing them in a water-bath, to drive atmospheric air from the bottle by rarefication. Appert, by the same means, produced a partial vacuum in cases containing meats and vegetables, by which mode, when carefully executed, they have been found to be preserved for a considerable length of time; but so long before as 24th January, 1795, Bentham specified in his patent of that date, the preserving of meat in a perfect vacuum. After stating that atmospheric air is an obstacle in arts and manufactures in a great variety of ways, the patentee proceeds:—

"1st. *Preservation, in point of Sub-*

stance. There are few substances but what, when exposed (as in the natural course of things, almost every thing is,) to the action of atmospheric air, are subjected to certain alterations, which are understood to depend in great measure upon the presence of that element, and which, so far as that is the case, may be prevented by its extraction and exclusion. Such, for example, are the putrefaction of animal and vegetable substances in general, the alteration which causes rancidity in oil, the rusting of metals, &c. The practice of potting solid substances in a substance which, like fat, is fluid in the degree of heat at which it is applied, seems to owe its preserving quality in good measure to the exclusion of the air, by means of the fat insinuating itself into all the vacuities. Where by an air-pump, or otherwise, the air can be perfectly extracted from all such vacuities, and the subject kept inclosed in an exhausted chamber, a degree of preservation as perfect as in the former case may be expected." Again; on the subject of Impregnation, Article 5, the patentee says, "By the expulsion of the air this process may be facilitated in every instance. * * * So, for example, to the impregnating of meat, fish, and other kinds of provision, with saline solutions, or other antiputrescent applications; in which instance the laborious, tedious, and uncleanly operation of rubbing may be saved."—"So exsiccation may in some cases be employed with advantage in vacuo for the separation of fluids from solids," and "thereby drying substances impregnated with water or other fluids."

"As to the vacuum-chamber, or receptacle which is to be exhausted of air, * * * in general it should be no longer than necessary, since the greater the space left unoccupied by the subject in question, the greater the quantity of air to be extracted. In the same view there may be an advantage in adapting the form of the chamber in some measure to the form of the subject to be contained in it; of course it would not be made in the same shape for a plank of timber as for a barrel of provisions."

"For the accomplishment of such a variety of purposes, a variety of operations will require to be performed, to some of which a variety of machinery may be necessary * * *."

"To facilitate the extrication of air from bodies in different states, different operations may come to be requisite. Where the substance of the body is of an adhesive nature, the particles of an inferior stratum of it may come to be forced together by the pressure of the superior strata in such manner as to form a kind of cells, within which small masses of air may be pent up. In proportion as a mass is thus disposed to keep air entangled in it, to extricate the air it becomes necessary to break up the whole mass in such manner that the boundaries of the several cells may be broken down. This may be done by making the mass in its way from the vessel that contains it to the vacuum-chamber pass in a highly divided state; for instance, through a kind of colander or sieve. If the mass be too viscous to be treated as above, so much so as to form, for example, a kind of paste,—(butter for instance), it may be kneaded by a kind of stampers; or the whole mass may be forced through slits or holes, like maccaroni or vermicelli; or passed between rollers spreading it out into ribbons of any degree of thinness. From the apparatus thus employed in the comminution, the subject matter at the close of the operation may fall into the vessel (a cask for example), in which it is to be packed. The path of its descent may be inclined in order to leave room for a perpendicular descent for the purpose of pressure. This pressure may be performed, for example, by a kind of stamper or piston, so ordered as that the frequency of its descent shall correspond with the rate at which the cask is fed. When the cask has thus been filled, the cover, being conveyed by a movement from its station within the chamber to the top of the cask, may then be pressed down upon it by the same apparatus with which the mass is pressed in * * *. If the subject matter be in small masses of a yielding nature,—for example, in the form of minced meat, more or less dried,—it may be discharged into the cask by tilting. * * *."

The above extracts from Bentham's Patent are given at such length, because the exclusion of atmospheric air by some means is essential to the long preservation of meats, whatever be the other modes in which they are cured, and because in all cases the packing in vacuo would be found in practice on any con-

siderable scale to be the simplest and the cheapest way in which that exclusion would be effected. It being the oxygen in atmospheric air which promotes decomposition, the question presents itself whether some other of the constituents of that air, or whether some other gas might not be employed as a preservative of meats? Carbonic-acid gas, for example. Experiments founded on this idea would be worth trial, and chemical science would indicate the species of gas most likely to prove efficacious. It necessarily should be of a kind that could impart no ill flavour to meat, nor alter its texture, nor diminish its nutritive property. Many kinds of refuse have latterly been utilized, and it would be novel should the waste carbonic acid in burning lime come to be collected for preserving meat.

How far humidity, in the absence of oxygen, would induce decomposition does not seem to have been ascertained. Some fruits are habitually long preserved in water, even when it is not deprived of atmospheric air; cranberries, for instance, and in Russia the maroshka, a very delicate high-flavoured berry; so are apples sometimes, for winter use in pies.

A fit subject for experiment would be the preservation of other fruits, of many roots, and some vegetables, by simply keeping them in casks filled up with water. Were this mode found to be successful, the water would be desirable for many culinary purposes by giving flavour to many soups and stews.

Exsiccation is a well-known mode of preserving flesh and fish. In parts of South America, the dryness and warmth of the atmosphere suffices for curing rapidly slices of beef exposed to it; but in this country artificial means must be resorted to for obtaining the same effect. In the experiments made by Bentham, preparatory to his patent, meats were dried in a vacuum-chamber by alternately exhausting it of air, and then passing through it currents of heated air at a temperature as high as the meat would bear without alteration of its quality; but this experiment was not prosecuted sufficiently to ascertain the utility of this mode; it remains therefore to be ascertained whether exsiccation of meats, animal or vegetable, could be most advantageously performed in vacuo, or simply by exposing them to a rapid current of hot dry air.

A mode of preserving meat that has not yet been tried is, that of depriving it of its juices by pressure, then drying perfectly the solid parts, and evaporating to dryness the juices. In this mode the dried solid and the dried liquid parts would be to be added together when prepared for eating, adding a sufficient quantity of water for the imbibition of the solids, and to make the sauce of a stew, or the liquid part of a soup.

Exsiccation in both of the above ways would be much facilitated by reducing either meat or vegetables to very small masses, as for minced or sausage meat; and as they approached dryness, still farther comminuting them so as to reduce them to a powder.

By the modes above indicated no preservative whatever would be employed; the subjects, whether animal or vegetable, would by them remain possessed of all their original nutritive properties; but to ascertain which of them might be the best for the preparation of a sea store presents a wide field for experiment.

To proceed to modes of curing food by preservatives. Salt, spices, sugar, vinegar, creosote, are well known, and constantly used preservatives; all of them conducive to health when used in moderation, but all of them (sugar excepted) deleterious when employed in great quantity; they have been used, some of them separately, most of them conjointly with one or more of the others; but it has never been ascertained what the mixture may be of these preservatives which would the least deteriorate the substances preserved, especially their healthful and nourishing qualities. Salt alone is known to diminish butchers'-meat in bulk on cooking, to indurate it, and, by a long-continued use of provision so cured, to induce disease. A mixture of sugar with salt has often been employed in preparing hams, and has been found to give tenderness and delicacy of flavour unattainable in hams by salt alone. Probably sugar mixed with salt for preserving meat for long voyages would greatly diminish the deleterious effect of salt alone. Vinegar is too costly for general use, but the quantity supplied to a ship should all of it be previously employed for preserving vegetables as pickles—*real* vinegar, that is—not sulphuric acid. Spices are most of them at a higher price than could be afforded for a

general sea-store, though the common practice of preserving Christmas minced meat for many weeks by their means, combined with sugar, affords an example of their efficacy; and possibly ginger and pepper might be used to some extent without too much expense,—that is, in aid of other preservatives. Creosote, applied in the rude way of wood smoke, has long and frequently been employed in preparing hams, bacon, sausages, hung beef, &c., and with good effect, particularly in preventing what is called rust. How far an extensive use of so powerful an agent as creosote might injure health, there has been no attempt to ascertain. Probably a mixture of the several preservatives—salt, sugar, spices, creosote, in some proportion one to the other yet to be discovered—might be found best to ensure the keeping of meat for a considerable length of time, and in such a state as to be nowise injurious to health.

The potting of meats might also be advantageously introduced for seamen's victual. By potting is meant the partial cooking of meat, whether pounded or in masses, packing them in air-tight vessels, seasoning the subject with salt and spices, placing the containing vessel in a water-bath, so as to drive out air partially, then filling up the vessel with fat. The fat from bones might be economically employed for this purpose. Partridges so preserved had, above fifty years ago, been sent for experiment in a ship to the East Indies; on its return home, the partridges were cooked at Plymouth, and found to have retained their flavour, as well as being perfectly sweet. In this case, the trial was under unfavourable circumstances, since the birds were entire, whereas bones should always be taken from meat to be preserved—the quantity of air they contain being exceedingly difficult of extraction.

As to vegetables, besides the well-known modes of drying them whole, and of reducing them to powder, there are other long-experienced means of preserving them, by which they become eminently anti-scorbutic. Sour krout is so, and was proved to be so on an extensive scale during the American war of independence; in the course of it, our troops were sorely afflicted with scurvy. Sour krout was made in London, and sent out to them, the use of which put an end to the disease. The quantity prepared consumed all the cabbages that could be obtained within many miles of the metropolis; and they were cut by an engine having many knives on its circumference, each of them a yard long. Cucumbers are prepared in the same manner in Russia, and are daily served at the emperor's table, and are commonly present on the peasants' board. Both sour krout and cucumbers are prepared in the same manner, in as far as that both are lightly salted, then subjected to fermentation in a heat of about 70° Fahr., the vessel being closed up as soon as that fermentation has penetrated to the interior of the vegetable. The cucumbers are always surrounded by water, and the quantity of salt is that which, when dissolved in the water, will enable it to float a new-laid egg. If the climate of St. Petersburgh admits of the cultivation of cucumbers at a low price, surely that of England might furnish them at a rate not too high for seamen's victual.

Condiments have not hitherto been furnished to the amount desirable, either as to sanitory considerations or pleasurableness. Sweet herbs are easily prepared by drying them in dark chambers by means of a current of heated air, and long retain their fresh flavour if powdered and corked up in bottles, or other air-tight vessels. They give a zest to soups and stews, promote digestion, and are of very little cost.

Evidently meats preserved by many of the above modes, would need modes of cooking them different from the usual ones on shipboard; as also that new tastes would be to be acquired by seamen before they would relish a change of diet. Should Government institute experiments on victual, not only would the chemist and the mechanist be requisite, but also a good cook—a cook habituated to foreign modes of cookery by gentle heat, instead of a fierce fire to produce violent ebullition. Dried meats would require soaking in water at a temperature experiment would have to determine at first; but which, afterwards, the thermometer would indicate. A thermometer part of a cooking apparatus? Yes; one for ascertaining when fruits preserved by sugar were sufficiently boiled, was made, and in use above sixty years ago, and still remains in a useful state.

The inducing seamen to voluntarily

change their salted meat and tasteless soup for more wholesome and agreeable fare might not be difficult. It is said that when in their "homes" (as they are denominated), the sailors like variety of food. It would seem that new articles of diet should not be imposed upon them, nor at first be made considerable articles of sea store. A captain and his officers, not averse to novelty, might occasionally cause some meats, prepared in a new manner, to be served at their meals; their example would go far to recommend in the eyes of their subordinates any desirable change of victual.

Though the exclusion of atmospheric air be not in many instances particularized above, yet it is in all ways of preserving meats of first-rate importance; it is for the mechanist to devise apparatus for facilitating the requisite operation. Bentham's experiments were all made with a good common air-pump, to which suitable apparatus of his own contrivance was added; but little of this can now be found. His patent, however, indicates the needful.

Such sea-stores as biscuits, flour, cheese, so often deteriorated and made disgusting by insects, if packed in vacuo, would remain intact for an indefinite length of time. Atmospheric air, as it contains oxygen, is necessary for animal life; consequently, neither meal-worm, maggot, nor mite, could exist in a vessel deprived of it. Iron bins would be cheaper than casks or bags, as receptacles for stores of this nature, and would well bear the pressure of the external atmosphere without being too heavy.

It is not presumed that all the modes are herein indicated by which victual for the Navy might be well preserved; the subject is in a manner novel, exhaustively considered; but a good purpose will have been served should these lines induce a scientific, joined to a practical investigation, of the means by which food might be long kept without deterioration.

M. S. B.

MEMOIR OF THE LATE J. H. SWALE. BY T. T. WILKINSON, ESQ., F.R.A.S.

Part II.

(Continued from page 196.)

As has already been intimated, Mr. Swale commenced his mathematical career under the auspices of Mr. John Ryley, the "*Ferdinando*," "*Rylando*," "*Mr. Brookes*," &c., of the mathematical periodicals, and who has deservedly been styled by the late Professor Davies "*the father of the Yorkshire school of geometers*" (*Notes and Queries*, vol. ii., p. 438.) His communications to the *Yorkshire Repository* and Whiting's *Scientific Receptacle* are generally of an elementary character; and although there is a neatness in the "getting up" of the solutions, they do not very forcibly indicate the superior talents of their author. Some greater stimulus than the influence of Messrs. Ryley and Nicholson was probably wanting to arouse the dormant energies of their diffident student; and this seems to have been supplied by Mr. Whiting, in No. X. of his *Receptacle*, when he awarded the "*prize of Ten Numbers to Mr. J. H. Swale, for the greatest number of correct solutions*." From this period Mr. Swale's contributions to the mathematical periodicals of his time were very extensive, and his geometrical investigations soon became so much superior to those of most of his competitors, both as regards elegance of treatment and originality of conception, that the editors of existing and the originators of new scientific periodicals looked upon him as one of their most powerful auxiliaries. Yet notwithstanding his manifest superiority, as Professor Davies well remarks, "he never seems to have cared to compete with others, either by sending solutions to all questions alike, or by proposing and solving the most difficult only; his rule appearing to be, to send only when and what seemed to himself to be worthy of himself, from its novelty of principle or simplicity of result. Still his contributions, irregular as to time and place as this would render them, to these works are both numerous and remarkable. Wherever we see the name of "Swale," we are sure to meet with something new and elegant, and often with specimens of unequalled resource and unexampled method of research." ("Geometry and Geometers," No. VII. *Phil. Mag.*, June, 1851.)

In the early part of his career, he forwarded some interesting communications to the *Gentleman's Diary*, which may be seen in the original Diaries or in Mr. Davis's republication of that valu-

able serial. His name is there associated with those of Hilton, Cunliffe, Gough, Dalton, Lowry, Nicholson, Campbell, Skene, Whitley, &c., &c.; and although he was then but young in science, his solutions will frequently bear close comparison with those furnished by more experienced contributors. On the establishment of the *Mathematical Repository*, Mr. Leybourn enlisted Mr. Swale into his service, and not only did he furnish numerous articles to that extensive periodical himself, but on several occasions undertook the office of caterer for the good of the mathematical public. Two of his letters to Mr. James Wolfenden are still in existence, and copies have been printed in the *Mechanics' Magazine*, No. 1342, in which he expresses his anxiety to secure the services of that somewhat eccentric, but able Lancashire mathematician for the *Mathematical Repository*. Besides the numerous geometrical questions proposed and answered by him in both the Old and New Series of this work, he communicated demonstrations to several of Dr. Stewart's "General Theorems," and also to the majority of those which have usually, but erroneously, been termed "Lawson's Geometrical Theorems," from the circumstance of his having published them collectively at the end of his "Dissertation on the Geometrical Analysis of the Ancients." Mr. Swale's solutions to these questions are remarkable for their neatness and originality, and in these respects are fit companions to those furnished by Messrs. Campbell, Lowry, and Nicholson. None of these writers, however, seem to have been aware whence the Rev. John Lawson derived the greater portion of his beautiful collection; but such was not the case with another writer in the *Repository*, who veiled himself under the disguise of "Peletarius." All the solutions furnished by this gentleman are given under the strict forms of the ancient geometry—the analysis and synthesis following each other in *reverse* order, step by step, and are nothing more than literal *translations* from Dr. Stewart's *Propositiones Geometricæ—the original source whence Lawson copied nearly all the theorems which pass under his name!!!*

After Mr. Swale's removal to Liverpool, the onerous duties of "Brunswick-place Academy" prevented him from corresponding so extensively as before; yet he maintained a familiar intercourse with the editors, and occasionally contributed to most of those periodicals which had been the means of establishing his character as a geometer. In 1823 he dedicated the first number of *The Liverpool Apollonius* to "Thomas Leybourn, Esq., Professor of Mathematics in the College at Sandhurst—the ardent, persevering, and able promoter of Mathematical Science .... as a token of grateful recollection of thirty years' correspondence;" and ten years later—"21st May, 1833"—the MS. volume, No. VII., thus records his undiminished attachment to this worthy veteran in science, "Received a letter from Mr. Leybourn, of the Military College, Bagshot, kindly inquiring after my health, accompanied with a printed half-sheet of the questions to be answered in No. XXVI. of the *Mathematical Repository* ...... Leybourn is one of my *early* scientific correspondents, having written to him thirty-eight years. I hope yet to spend a week with him at Bagshot. At the same time, I should greet Lowry, another *old* correspondent, and Cunliffe, &c. On such an occasion we should take our harps down from the willows, and *once more* tune them to the songs of science!" When the *Liverpool Student* was established, Mr. Swale was ready with a helping hand. He furnished solutions to most of the questions in the first two numbers of that "work of rare merit," and proposed several others; but his removal from Leeds to Chester, and other engagements, prevented him from continuing his correspondence to the remaining portion of this periodical. He, however, subsequently formed a personal acquaintance with the Editor, Mr. William Hilton, who was originally a resident at Saddleworth, near Manchester, a pupil of Wolfenden, and a noted correspondent to most of the periodicals of his time. Mr. Swale was ever happy to meet with "kindred souls," and Hilton's partiality to "divine geometry" would form an additional motive for a close attachment. "This day, 8th May, 1826," says the MS. volume vii., p. 34, "poor Hilton fell dead from his chair whilst *laughing* over his pot of porter! Such is the fate of man!" The sudden termination of

Hilton's earthly career is elsewhere alluded to in nearly similar expressions of regret; nor are these the only melancholy memorials he recorded of the uncertainty of human existence. On a subsequent occasion he remarks, "This day, 28th August, 1833, confirmed the death of poor Tom Briggs, my early mathematical pupil; son of my old friend, Dr. Briggs, who with many of his colleagues in Lander's expedition, in which he engaged as physician, perished in some part of Africa by malignant fever. I sincerely pity his parents. Oh! ye melancholy vicissitudes of life, what a lesson you read to the sanguine desires and hopes of man!" (MS. Volume vii., p. 152.) In recording the severance of domestic ties by the rude hand of death, his remarks on every occasion bear testimony to the poignancy of his feelings and his goodness of heart. He was ever the dutiful son, the kind and indulgent father, nor did his anxiety for the welfare of his own children exceed in intensity his desire for the comfort and happiness of his parents. On the "8th June, 1828," he remarks, "this day (1826) died my dear father, aged 80¼ years—old and helpless—life was a burden, and death desirable! Resigned and happy in his last moments—the consequence of a life of simplicity and integrity. May my last moments be like his!" The "11th September, 1828," brings to his remembrance another melancholy anniversary, for "on this day (1813) died my indulgent mother, aged 77. Oh, my mother, dear and afflictive is my remembrance of thee!" On "August 12, 1835," he again reverts to these sad remembrances, for the stroke of death had now fallen upon one of his own offspring. Alluding to the former dates, he remarks, "These with me are sad and melancholy days of bereavement, on which died a fond mother (1813), an affectionate sister (1825), a kind and aged father (1826), and my first-born beloved daughter (1834)."

Mr. Swale's first contribution to the *Gentleman's Mathematical Companion* appears in No. III. of that work; and he continued to correspond at intervals until the appearance of No. XV. In 1802, he and Mr. John Ryley obtained the "Prize of twelve *Companions* each," but owing probably to the neglect complained of in his letter to Mr. Whitley, he ceased to be a contributor in 1812. During the editorship of Mr. William Davis, his investigations extended to a considerable length, and are peculiarly distinguished for neatness and originality. A close intimacy sprung up in consequence between the Editor and himself, which ended only on the death of the former. In MSS., vol. vi., p. 82, the following tribute is paid to the memory of his departed friend.

"*An Extract from one of my Mathematical Books.*

"February 24th, 1807.

"Received a letter from Mr. John Hampshire, mathematician, London, written at the request of Mrs. Davis, acquainting me with the premature death of my much esteemed friend, William Davis, editor of the *Mathematical Companion*. I deeply lament the loss of my old mathematical correspondent. But time makes incessant breaches in all our sources of comfort, and withers our cherished hopes of the future. On the receipt of Mr. Hampshire's note, I transmitted to the *Leed's Mercury* the following:

"'Mr. Baines,—Would you oblige a reader by the insertion of the following in your Obituary of Saturday next.

"'Yours respectfully,
"'J. H. Swale.

"'*Died,*

"'A few days ago (February 8th, 1807), at his house in Aldersgate-street, London, Mr. William Davis, who united to the high character of an *honest* man, that of a zealous friend to science. Besides several *original* productions which he has given to the world, we are indebted to him as editor of the *Principia of Newton*, and the invaluable volumes of *Maclaurin* and *Simpson*. His private, social, and literary worth will live in the affectionate remembrance of his acquaintance and friends,—one of the most sincere of which, pays thi humble tribute to his memory.'"

When the *Leeds' Correspondent* was established in 1813, Mr. Swale was too much engaged with the duties of a large academy to devote much time to mathematical correspondence. The fact, however, of the mathematical department being successively under the care of his early friends and associates, Messrs. Ryley, Gawthorp, and Whitley, induced

him to take an interest in the work, and some of the most beautiful specimens of his method of treating isolated geometrical problems found their way into the successive numbers of this valuable periodical. One of these has recently been re-published by the late lamented Professor Davies as the "Prize Question" in the *Lady's and Gentleman's Diary* for 1851; and notices of several others may be seen in my account of the *Leeds' Correspondent* (*Mech. Mag.*, vol. xlix., pp. 203-4, 303-6). The literary department of the same periodical also contains some elegant themes and translations from the French and Latin languages by his pupils, Messrs. Watson, Roberts, and Macauley.

(*To be continued.*)

THE OPERATIVE ENGINEERS' STRIKE.
FOURTH LETTER.

Sir,—It may perhaps be objected, that I have argued the question, as if the engineers had struck for an advance of wages; whereas, they have complained only of over-work, and not of under-pay. But it is obvious that this makes little or no difference; at any rate, to the employers, who lose as certainly by non-compliance with their conditions as they would by a demand for higher wages.

There are, certainly, some cases in which the hours of labour (or rather of *attendance*) may be shortened without pecuniary loss to the master, and with great benefit to the servant; and I can cordially agree with the advocates of the "Early Closing" movement as one full of advantage to one party and injurious to none. The old system of perching men behind counters for hours *doing* nothing, was "frivolous and vexatious" in the highest degree, and the sooner it is abolished the better.

Since writing my last letter, I am sorry to see that some members of the "Amalgamated Society of Engineers" have been behaving in the most disgraceful way towards those who refused to join them, or who presumed to quit them. The Thames Police-court has had to take cognizance of various assaults by some of their body on those who have thus offended them. If the respectable and honest members of this Society do not at once most decidedly disavow such acts of outrage, and withdraw from all intercourse with the perpetrators, they will most assuredly ruin their own cause and lose every particle of sympathy or respect which they may have gained. It is almost inconceivable that men who are themselves clamouring so loudly for protection from the alleged tyranny of their employers, should thus brutally tyrannise over their fellow workmen.

Before I conclude, I have a few remarks to make on the subject of Co-operative Associations of Labouring Men. That I am anything but prejudiced *against* such experiments, the readers of this Magazine will have seen by the articles I contributed in a former volume, on "The Effect of Machinery on the Welfare of the Labouring Classes." Some experiments of this kind appear to have answered very well indeed, and to afford encouragement to extend them. But those who imagine that in this they have discovered a simple and effectual remedy for all the evils of competition and large capitalists, can hardly have reflected much on the difficulties involved in these Aassociations. I may, perhaps, enter more fully into this question in a separate article; but for the present I will content myself with referring the reader to some facts and observations contained in a work (published by the Chambers') of Mr. Burton, on "Political and Social Economy." I will just extract, from Chapter 6, the following Report of a conversation there quoted from the "First Report of the Constabulary Force Commissioners," p. 156.

"The Constabulary Force Commission had a conversation on this subject with an ingenious workman, who thought he saw the condition of the future regeneration of his class in their having the use of a part of the capital of the country. It was presumed, for the purpose of practically testing the soundness of his views, that 100,000*l.* being wanted, all questions as to the security of the loans having been got over, one thousand men had each tabled 100*l.*, and that there was among them perfect harmony and unanimity as to the course of management to be adopted."

The dialogue then proceeded thus:—

"Q. Supposing, however, all difficulties as to the capital overcome, a proper building erected, proper machinery obtained, and all contentions as to which of the co-operatives should take the best, and which the worst

and most irksome labour, settled, and proper subordination obtained, there still comes the business of buying the raw material; and next, that of selling the manufactured product; a business requiring, as you will admit, much skill promptly applied to guard against failure or bankruptcy. How would you that a committee should transact such business in the market?

"*A.* For that business it might undoubtedly be expedient that they should choose some skilful and trustworthy person.

"*Q.* Who, having large capital, or the success of the undertaking in his hands, and being open to the temptations of embezzlement or to large bribes on the betrayal of his trust, you would perhaps think it right should be well paid to diminish those temptations?

"*A.* Certainly. I see no objection to that; he ought to be well paid.

"*Q.* That being so, what would you, an operative capitalist, say, be willing to give to such a person for the management of your 100*l.* productively to obtain a return of weekly wages for your subsistence, for obtaining and superintending the fitting machinery, selecting and buying skilfully the raw commodity, and selling the manufactured produce, without any labour or care on your part?

"*A.* I have never considered the subject in that point of view, and can hardly say; but I think 4*l.* or 5*l.* a year would not be unreasonable; for my own part, I should not object to that."

"It may surprise you," continues the Querist, "and it is well that the respectable mechanics engaged in this branch of manufacture should know, that the service spoken of, is all rendered to them for one-half; now, indeed, when trade is depressed, for less than one-fourth of the sum which you, and perhaps they, would deem a fair remuneration; that the 100*l.* capital is furnished; the building erected; the machinery of the most efficient description supplied; and raw commodity purchased; the labour in working it up directed; the markets vigilantly attended, and the sales of the manufactured produce faithfully made at the best price, without any care or thought on their part; and that the manager or capitalist who is provided for you does all this, and is well satisfied with a remuneration of 40*s.* or 50*s.* per annum for each individual whom he serves whilst serving himself."

I would strongly recommend this little work of Mr. J. H. Burton to all the intelligent and really honourable men amongst the operatives; they will find half-a-crown well spent on it. I would also again recommend a little volume which I mentioned in my former series of articles; viz., "Capital and Labour," by Mr. Knight; published as one of his admirable series of "Shilling Volumes." There are hundreds of thoroughly well-meaning men amongst all branches of the working classes, who only get wrong on these points for want of more extended and accurate knowledge of the facts bearing on them. *Ignorance* lies at the bottom of a very great portion of the discontent and sour feeling which prevails amongst them. For this the wealthier classes may thank themselves. If masters and employers would only exert themselves in the task of educating and elevating their operatives: if they would only mix more freely with them; they would find it *pay* them, even in a pecuniary point of view. These incessant "Strikes" and combinations may be traced, and not very remotely either, to the culpable neglect and apathy of the masters themselves. For the present I conclude.

Yours, &c.,

A. H.

SHIPS' BOATS.—HOW TO KEEP THEM READY FOR USE.

Sir,—There has never appeared to me sufficient reason for suspending ships' boats, so that they have to be lifted over high bulwarks every time they are used. The numerous accidents which have occurred lately, and which rendered the immediate use of boats necessary, have probably quickened the inventive powers of those who desire to improve upon our present plans, and very likely the improvement which I here suggest has been already proposed, and it may be even adopted. I would cut a gap in the bulwarks equal in length to the boat stowed on deck, and make this length of bulwark moveable, turning downwards on a hinge, opening to the outside.

By this means, the boat would never require to be raised more than an inch or so above the deck, and the "davits" would consequently be shortened about three feet, which would make them less weighty and cumbersome, and less liable to be fouled by the braces and other running gear. It can hardly be said tha the ship's bulwarks would be *weakened* by this division. Something of the

same sort is done at present in men-of-war steamers where large deck traversing guns require the horizontal obstructions to be removed.

At each end the stanchions would be of double strength, and seem partly to support the davits fixed alongside them. If the boat were kept swung, and resting on three or four wedges as "chocks," by pulling them away, and taking out one bolt at each end of the bulwark, the boat filled with people might be launched merely by pushing it outward by main force.

The open space would also form a roomy gangway, and the convenience of the plan would certainly conduce to a more constant use being made of ships' boats on ordinary occasions in harbour, &c., when it is notorious that they are now but seldom used, under the supposition that the extra wear and tear of the beading and other ornaments outside the ship, as well as of the tackle of the boats, is not compensated for by the advantages of the crew being frequently practised in using what they must resort to in cases of great danger.

Again; this moveable bulwark might itself be made both light and strong, so as to serve on emergency as a life-raft, and thus, without occupying any additional stowage-room, be ever at hand as a last resort. These suggestions are intended specially for the case of steamers; and I have noticed, that in nearly all steamers the boats are so swung as to take up a great deal of room on deck, and whether hoisted up to the davits or not, they are equally in the way of the passengers. Now, in fine weather, if this bulwark were allowed to fall down, and the boat moved so that its keel should rest exactly on the edge of the deck, we should thereby gain half the width of each boat as area room on deck, without hoisting the boat up so as to catch the wind, or hoisting it outside the ship.

I have not insisted (because it is sufficiently manifest) upon the very great advantages of this proposed plan when the boats have to be lowered in a heavy sea, or a time of excitement. The men

working them would, in such a case, *see* the boat they are lowering as they stand on deck; and the impossibility of doing this, as things are at present managed, has conduced to the frequent and dreadful disasters of lowering the stem and stern unequally. In the burning of the *Kent* East-Indiaman, which took place when I was on board, a boat was lost by one tackle getting fast and the other becoming slack, as the end was lifted by a high wave.

Yet here, again, in the *Amazon* we find the same fatality occurring without any effectual remedy being yet known to exist to prevent it.

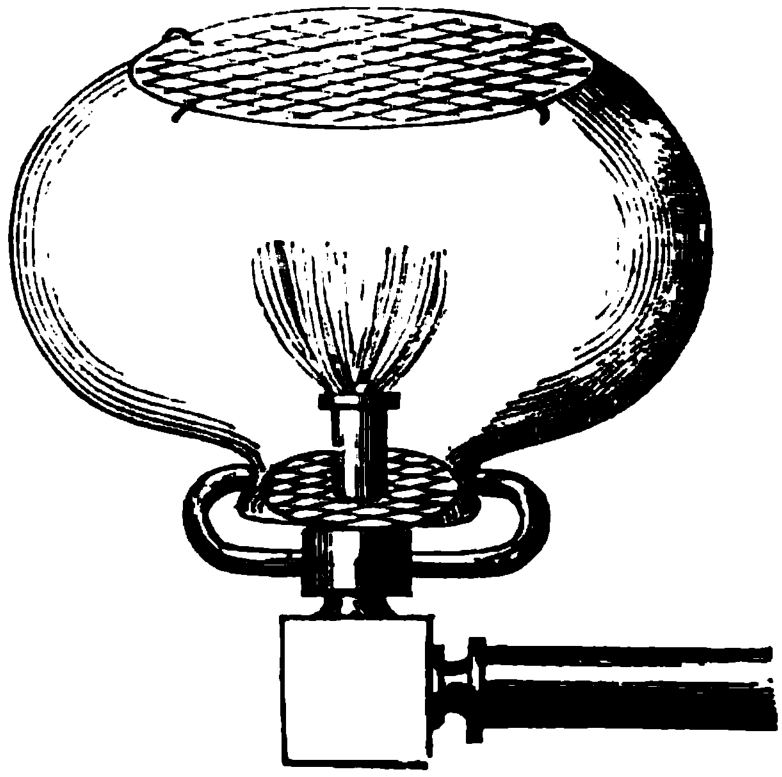
What I have mentioned above does not, of course, go to a complete prevention of such a catastrophe. That man will be a benefactor to our Navy who can devise a simple mode of lowering a ship's boat.

I cannot conceive why it is that the companies which provide splendid and expensive steamers, are so niggardly in their arrangements for the safety and comfort of the passengers. Having had lately to travel very frequently in several first-class steamers, I have in all been surprised to find saloons gaudily decked out with costly pictures and velvet couches—yet on getting into one's berth, a sheet about two feet wide is the stingy covering allowed: the steward has to be supplicated to obtain a clean towel; and if one were to hint at or ask for a life-preserver—merely to know, for satisfaction's sake, where it is stowed—ten to one but the captain would take it as an insult to his whole concern. Suppose a few gentlemen were to make out a list of all the railway and steam-vessel conveyances in Britain, and to append to each a scale of prices per mile—speed, age of ship, average number of passengers, quality of food and accommodation, civility and attention of servants, provision for safety, and width of seats, and *breadth of sheets*.—I am sure that no traveller would grudge to pay for such a useful little hand-book, and that the receipts of its sale would enable several competent trustworthy "commissioners" to be employed in constantly travelling in order to secure its accuracy. To apply the same to hotels would be a larger work, but not less certainly useful and remunerating. A few good names commencing such a system of public investigation, would at once obtain the confidence and support of the very numerous class who constitute our migratory community, and I throw out this hint in the earnest hope that it may be adopted. I have sketched the "lowering bulwark," so as to show the appearance of the boat; first, when lowering; second, when in fine weather, forming the temporary rail of the ship's quarter-deck. The paint, &c., would, in lowering the boat, be less damaged than at present, for the *inside* of the lowering bulwark would be turned to the boat's side, and the ports, &c., would be thus protected.

Yours, &c.,
JOHN MACGREGOR.

Temple, March 3, 1852.

FONTAINEMOREAU'S PATENT GAS-BURNERS.



Sir,—I perceive by your Magazine of to-day that a Patent has been taken out by M. Fontainemoreau for "Improvements in Apparatus for Gas-lighting."

I have, of course, no right to complain; nor do I notice the invention for the purpose of becoming an opponent. I must necessarily suffer the just punishment of procrastination, as I have been *talking* of a "registration" for the past twelve months, but have not carried my intention into effect.

The burner with which I have used the wire gauze is what is termed a "fish-tail." When the gas was introduced into my room, about fourteen months ago, I was so much annoyed by the flickering of the light, that I found it would be necessary either to have a different kind

of burner, or to devise some method of protecting the flame from the current of air. I chose the latter, and applied "wire gauze" to the lower aperture of the glass globe, and also to the top, which fully answered my expectations.

I have continued to use this apparatus with the utmost satisfaction since January, 1851. The effect is not simply to regulate and steady the flame, which it does *perfectly*, but the *amount of light is increased*, I conceive, *at least one-fourth*, and a saving of gas thereby effected.

I would strongly recommend Mr. Fontainemoreau to "push" the invention, as I am satisfied that any person, having once used the guard, will never tolerate a "fish-tail" burner without this desirable appendage. Wishing him every success,

I am, Sir, yours, &c.,
WILLIAM MORGAN.

Bromsgrove, March 6, 1852.

P.S. I append a sketch of the guard and glass, which I have used with complete success.

NEW ROCHESTER BRIDGE.

We lately had an opportunity of inspecting these works, and, as the mode of constructing these foundations appears not only admirably contrived, but particularly applicable to the repair or renewal of bridges in the metropolis, we propose to give a short description of the work. The bridge is to be carried over the Medway with three arches—a central one of 170 feet, and an arch on either side of 140 feet span. The abutments and the piers (above low-water mark) will be built of stone and brick in the usual way, and the arches will be of cast iron. The roadway is designed to be 40 feet wide, and an opening bridge of 50 feet in width is to be made on the Strood side for the navigation of the Medway. During the season of the Great Exhibition, the works in progress were visited by several of the first engineers of the Continent; and last Thursday the contractors, Messrs. Fox and Henderson, entertained a large party of eminent men, invited to witness the sinking of the last pile upon the plan devised to meet the unexpected exigences of the occasion. The Strood-pier is completed up to a little above low-water level, and can only be seen at that time of the tide. The foundation consists of massive cast-iron bed-plates, covered with concrete, resting upon a series of cast-iron cylinder-piles, sunk through the bed of the river into the chalk, 46 feet below the concreted surface. These piles stand about five feet above the bottom of the river, and are inclosed by a curtain of cast-iron plates, serving to direct the flow of the current and to protect the piles from injury between ordinary and extreme low-water level. This pier, as well as the other on the Rochester side, measures over the surface of the bed-plates 70 feet between the points of the cutwaters, and 18 feet in width. The iron cylinder piles, which support the bed-plates, are arranged in two rows of six in each, and one pile at either end, carrying the points of the cutwater; they are 7 feet in diameter, and are formed of cylindrical castings, 9 feet long, bolted together in succession as the pile enters the ground. The stones, gravel, chalk, &c., are excavated and entirely removed from the interior of the piles, and a concrete of gravel and Portland cement is substituted when the pile has reached a stratum sufficiently hard to support the weight of the bridge.

To sink these piles 40 feet into the bed of the river, and to effect the excavation where, at low water of ordinary tides, there is 5 feet, and a rise of upwards of 20 feet at high tide, was, under the circumstances which presented themselves here, a problem of no common character. In suitable soils (and this was at first thought to be one of them) the vacuum method, which was patented by the late Dr. Potts,* would assist in solving the question, if it did not succeed for the whole of the great depth of these foundations. An alternative presented itself of clearing the piles from water, by means of powerful pumps, driven by steam engines of from 12 to 20-horse power, and working out the excavation when the bottom was laid dry. Such was the method followed on a magnificent scale by Mr. Brunel with the greater part of the cylinder piles forming the supports for the remarkable bridge intended to carry the South Wales Railway across the Wye, at Chepstow; and such suggested itself as the resource to be called into action, after a few trials had proved Potts's method to be quite unavailable at Rochester. A careful examination of the ground forming the site of the Strood-pier, during a very extraordinary low tide, which occurred shortly after the attempts with the vacuum method had failed, and when measures were in progress for introducing water-pumps, brought out the fact, not previously known, that the bottom

* For the first published account of this valuable invention, see *Mech. Mag.*, vol. xl., p. 433.

of the river there consisted of large rubble stones, intermixed with old but solid timber for a considerable depth, not less than six feet, as was then estimated, but which has proved to average twenty feet; and it became evident that any effort of pumping would cause a very large profitless outlay of money, and would result very much as would an attempt to make the surface of a sieve dry by withdrawing the water above it in the same way.

The principle of the diving-bell had been previously spoken of by many, in general and indefinite terms, as being probably useful in connection with the system of iron cylinder piles; and it was now seriously discussed by the engineer and the contractors in all its forms, from the employment of divers in the helmet and caoutchouc dress to the use of the ordinary diving-bell, suspended inside the cylinder pile. It was sufficiently obvious that the cylinder pile itself might have the character of a diving-bell given to it by securely closing the top, and by forcing air into it until this had acquired a density sufficient to force out the column of water; but how to get the workmen into and out of a large iron vessel so closed up, how to carry off the stones, earth, &c., which had to be removed from its interior, and how to introduce the concrete and brick-work for filling it up, although equally obvious as conditions that must be satisfied (and satisfied, too, in a well-ordered system to be carried into operation as any process usual in a properly-regulated manufactory) were difficulties at first very imperfectly resolved.

Mr. John Hughes, as the engineer upon whom it devolved to devise and arrange the preliminary works and mechanical means for carrying out the contract which Fox, Henderson, and Co. had entered into, offered some suggestions to Sir W. Cubitt and to Sir C. Fox, which were favourably received, and they assigned to him the task of making the drawings and scheme complete, of constructing all the necessary apparatus, and of carrying it into operation. This duty he performed, and has described his contrivances in a paper read at the Institution of Civil Engineers last year. A technical account of the apparatus, which all who have seen it pronounce to be most ingenious, well considered, and effective, would be unsuited to our columns, and is already recorded in the proceedings of the Institution of Civil Engineers; but we may quote the address of Professor Airy, when President of the British Association, at Ipswich, in July last, as conveying a popular idea of it. The Astronomer Royal said—"Considerable importance, however, is attached by engineers to some of the processes lately introduced, especially that of thrusting down an air-tight tube or elongated diving-bell, supplied with air at the proper pressure, by which men are enabled to perform any kind of work under water, in almost any circumstances, and in which men or materials may be transferred without disturbance of the apparatus, by a contrivance bearing the same relation to air which a common canal-lock does to water."

That the working of this useful contrivance has been eminently successful may be judged by the fact that the 14 piles in the Strood-pier of Rochester-bridge have been excavated 40 feet into the bottom of the Medway, and this was done without regard to the period of the tide or of the day. The pressure of air in the pile averaged about 18 pounds per square inch, the *maximum* being nearly 26 pounds, or equivalent to a depth of 60 feet of water. In the Rochester-pier 13 of the piles have been completed to a depth of 22 feet in the bottom of the river, and the *maximum* pressure during the execution was about 15 pounds to the inch. At Chepstow two of the cylinder piles were sunk 48 feet below the bed of the river by Mr. Hughes' arrangement, under the direction of Mr. Brunel, the *maximum* pressure being 28 pounds to the inch.

After satisfying ourselves of the solid character of the completed platform for the Strood-pier, we crossed over to witness the sinking of the 14th pile for the Rochester-pier by means of the apparatus just noticed. The pile, standing on the bottom of the river, contained water to the same level inside as on the outside, which was 7 or 8 feet deep at the commencement of a flood tide. The air-pump, driven by a neat six-horse power portable steam engine, being set to work, the pile was free from water in five minutes, the workmen then passed through the cages or air-locks and descended to the bottom of the river and proceeded with the excavation. Bucket after bucket was sent up through these air-locks until sufficient material had been cleared away to admit of the cylinder's further descent. The men were then recalled, the air let off, and, as the water rose, the cylinder, by its own weight, sank to a new footing. The process is thus repeated until the men have been enabled to carry the foundations to the necessary depth.

To say nothing of the complete safety under which the work can be carried on, and the small space of the waterway occupied during its progress, the advantages claimed for this system of foundations are their cheapness as compared with foundations formed by means of cofferdams, whether of

timber or iron, and the security with which the superstructure can, without introducing timber piling, be raised on a bed of rock or of earth, known to be equal to the load it has to carry. Mr. Hughes's method of sinking these cylinder piles has added to these advantages the power to construct foundations under circumstances where they have hitherto been thought impracticable; the time required for accomplishing a foundation of given magnitude, and the cost to be incurred, are also reduced to a certainty capable of exact calculation.—*Times.*

SIR WILLIAM BURNETT'S WOOD-PRESERVING PATENT.

Privy Council, February 7, 1852.

The hearing of Sir William Burnett's application for an extension of his Patent, granted July 26, 1838, for improvements in preserving wood and other vegetable matters from decay (and which was about expiring), took place on the above named day, before the Right Honourable Lord Cranworth, the Right Honourable Sir Stephen Lushington, the Right Honourable Sir Knight Bruce, and the Right Honourable Sir Edward Ryan.

Sir Frederick Thesiger, who appeared to support the application, represented to their Lordships that Sir William had devoted a great deal of his time, and had been at considerable expense in prosecuting his experiments; that from the peculiar nature of the invention, it necessarily required a great number of years before its efficacy could be satisfactorily tested; that from this cause and the inefficacy of previously made discoveries, which induced persons to be rather distrustful of new inventions, it had been a work of very great difficulty, and one requiring a greater portion of time than the patent allowed to be consumed in inducing public boards and other public bodies to adopt the invention, so as to render it adequately remunerative. He then proceeded to call witnesses to prove the efficacy and valuable nature of the invention, both as regarded the preservation of wood and canvas; on both of which numerous trials have been made, and the superiority of the process over all of those hitherto adopted. Their Lordships having satisfied themselves on these points, and also that the accounts were satisfactory; and no opposition being offered to the application, granted an extension of the Patent for a period of seven years.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MARCH 11, 1852.

TIMOTHY KENRICK, of Edgbaston, Warwick, iron-founder. *For improvements in the manufacture of wrought iron tubes.* Patent dated September 4, 1851.

These improvements consist in enamelling and glazing the interior surfaces of wrought iron tubes.

For this purpose the patentee employs two compositions—one to form the body, and the other the glazed surface. The body glaze is composed of 100 lbs. calcined flints, reduced to a fine powder; 75 lbs. borax, also in powder: these ingredients are fused into a mass, and, when cold, ground in water, dried, and mixed with potter's clay in the proportion of 40 lbs. of the composition to 5 lbs. clay, and sufficient water to produce a paste of a creamy consistence. The glaze is to be poured into the tube, and the tube turned round so as to expose every part of its surface to be covered by the pasty mass. The second glaze is then applied, in a state of powder, over the whole interior surface, and the tube is then heated in a muffle until the glazes are melted. Should the whole of the interior, however, not have been properly covered with the surface glaze, it will be necessary to apply a further quantity of it, and to reheat the tube sufficiently to vitrify the additional quantity so applied. The surface glaze is composed of 100 lbs. Cornish stone, 117 lbs. borax, 35 lbs. soda ash, 35 lbs. saltpetre, 35 lbs. sifted slack lime, 13 lbs. white sand, and 50 lbs. white glass in powder. These several ingredients are calcined together, ground in water, and dried. To 45 lbs. of the mixture, in powder, is then added 1 lb. of soda ash, and they are mixed together in hot water, and, when dried, produce a powder which is used as above directed.

The patentee observes, in conclusion, that the surfaces of cast iron tubes have heretofore been enamelled and glazed, and that, therefore, he claims the enamelling and glazing, in the manner described, the interior surfaces of wrought iron tubes only.

DOMINIQUE JULIAN, of Sorgues, France. *For improvements in extracting the colouring properties of madder, and in rendering useful the water employed in such processes.* Patent dated September 4, 1851.

These improvements are applicable to madders of all descriptions. The patentee takes 2 cwts. of ground madder, which he places in a vat, and adds thereto 115 to 118 gallons of water, according to the degree of fineness of the madder. He then runs the liquid madder into a filter composed of woollen cloth, strained over a frame, and

supported inside a large vat, which should be provided with a tap for the purpose of drawing off the water which passes through the filter. The filter itself should be capable of containing six cwts., so that it may be filled by repeating the above operation three times. After all the water has passed through, the pasty mass of madder is placed in bags and subjected to pressure in a hydraulic or other suitable press, for the purpose of expressing all the remaining water, which is to be added to that already contained in the vat. The madder is then to be dried by exposing it in a suitable chamber to heat of from 120° to 160° Fahrenheit, and when dry it is to be thoroughly mixed, so that every part of it may be of equal quality. In this state it is called flowers of madder, and a given quantity of it will be found to produce a better effect in dyeing than an equal weight of madder not so prepared. It also gives the Turkey red to calico dyers, and facilitates the dyeing of wool.

The waters which have been obtained as above mentioned, are placed in vats capable of holding from 2500 to 3000 gallons, and subjected to a temperature of about 70° to 85° Fahrenheit, to induce alcoholic fermentation. If this should not take place in five or six days, a small quantity of hot water, having barm dissolved therein, is to be added. The strength of the liquor will be at first from 3° to 8° Baumé, but as soon as fermentation has commenced it will not be more than 1° or 2°. The fermented liquor is subsequently submitted to distillation, for the purpose of obtaining spirit therefrom.

HENRY ALFRED JOWETT, of Sawley, Derby, engineer, and JOHN KIRKHAM, of Peckham, Surrey, engineer. *For improvements in hydraulic telegraphs and in making signals.* Patent dated September 4, 1852.

Claims.—1. Certain arrangements whereby the driver of a railway carriage or train can always ascertain how far the last preceding carriage or train is ahead—that is to say, in so far as regards the employment of an indicator on the hour-glass principle in combination with the means by which the same is actuated.

2. Certain arrangements for the prevention of accidents in railway tunnels, and at other points of railways.

3. Five several improvements in hydraulic telegraphs.

4. An apparatus for enabling the guard of a railway carriage or train to communicate with the driver thereof.

PIERRE ARMAND LECOMTE DE FONTAINEMOREAU, of South-street, Finsbury. *For certain improvements in preserving animal substances from decay by means of a composition applicable to the cure of certain diseases.* (A communication.) Patent dated September 4, 1852.

These improvements consist in the employment of metallic salts, but principally of sulphate of zinc in aqueous solution, for the preservation of corpses, and anatomical parts, and animal substances generally, and to the cure of wounds and external diseases.

For the preparation of the sulphate of zinc, any salt of that metal may be employed; but the patentee prefers to employ metallic zinc in a granulated state. This he dissolves in such a proportion of dilute sulphuric acid as to produce a solution of a strength of about 30° to 40° Baumé. After allowing the solution to stand for a time sufficient to cause the deposition of the foreign matters held in suspension, he decants the clear, and employs it in the preservation of corpses by injecting through an artery. If the subject is to be exposed to the air, or kept in a naked state, the patentee recommends that a third part by weight of spirits of turpentine should be mixed with the solution; he employs also other essences when odours of any particular kind are required, and colours the fluid red.

When animal substances are to be preserved by immersion, the solution is made in the same way as above mentioned, only that it is employed at a strength of 20° to 25° Baumé. If the solution is to be employed for purifying rooms from the taint of decomposing organic matters, it is used of a strength of about 10° Baumé.

For the cure of wounds, the solution is prepared in a highly concentrated state, and reduced to 3° to 4° Baumé, by the mixture therewith of decoctions of linseed, marsh-mallow, and other emollient herbs. In this state it is used by saturating lint, and applying it to the wound. The solution may also be reduced to 2° or 3° Baumé, and used as a wash for the hands.

Claims.—1. The application of metallic salts, but principally of sulphate of zinc at the degrees of strength mentioned, or thereabouts, for the preservation of corpses, anatomic parts, and animal substances in general from decay.

2. The application of the solution described, combined with emollient substances to the cure of wounds, and other similar external diseases of the human body.

BARON CHARLES WETTERSTEDT, of Grosvenor-street, Commercial-road. *For improvements in preserving animal and vegetable substances.* Patent dated September 4, 1851.

The first part of this invention consists in preserving animal and vegetable sub-

stances by drying the same when mixed with flour of corn or potatoes, and packing them in air-tight cases. The patentee takes beef or mutton, and having removed the fat and bones, he cuts or chops the meat into small pieces, which he mixes with flour, and then exposes to a gradually increasing heat (say from 70° to 120° Fahrenheit), in a suitable chamber, spreading the same on wire cloth or reticulate trays, in order to admit of the air acting equally on every part thereof. When dry, which will be readily ascertained by the vapour ceasing to arise, the meats or vegetables are removed and packed up in bottles, earthen jars, glazed inside and out with a glaze that does not contain lead. The corks or stoppers of the bottles, before being inserted, are dipped into melted beeswax, and their outside is covered with pitch and powdered coke. When the materials are packed in wooden barrels, the whole of the exterior thereof is coated with pitch and powdered coke. The coke powder may be also advantageously used to fill completely the interior of bottles, jars, or barrels, partially filled with meat or vegetables dried and prepared as aforesaid, care being taken that the materials are covered from contact with the coke employed.

The second part of the invention has relation to the preservation from decay of canvas and other similar fabrics. For this purpose the patentee takes fresh-burnt lime, which he slacks with water to reduce it to powder, and he adds thereto one part of powdered resin for every ten parts of lime. These materials he diffuses in hot water, and sprinkles through a sieve over the surface of the canvas or fabric, using a brush to cause the same to penetrate well into the fibres of the cloth. Simultaneously with this operation, he also sprinkles the canvas with a mixture of ten parts of linseed to one part of sperm oil. The canvas or fabric is ready for use as soon as dry. Sixteen pounds of the lime mixture and two gallons of oil will be found sufficient to prepare in this manner 1000 yards of canvas.

GAIL BORDEN, jun., of Galveston, Texas, manufacturer. *For improvements in the treatment of certain animal and vegetable substances to render them more convenient for use as articles of food, and for their better preservation.* Patent dated September 5, 1851.

These improvements consist in manufacturing meat biscuits by combining the nutritive properties of animal flesh in a concentrated state with farina, flour, meal, or pulverized biscuit, and then drying or baking the same.

The patentee selects meat of any description in good condition, and boils the same by the aid of steam until the whole of the nutritive principles are extracted. He then strains the liquor, and after allowing it to stand, to give time for any suspended impurities to settle, he evaporates the same in the vacuum pan, or by other suitable means, to the consistence of thick treacle, skimming off the fatty portions which rise to the surface, and adds, while still in a hot state, a sufficient quantity of flour meal or pulverized biscuit, to produce a stiff dough, which he kneads well, and rolls, or presses, and cuts into the form of biscuits. These biscuits are then dried or baked in an oven, and afterwards packed in air-tight cases or bags to preserve them for use. Or they may be ground or reduced to powder, and packed in that state in air-tight cases for preservation.

For the purpose of making soup, the powdered meat biscuit is mixed with hot water, and, after standing, is boiled with the addition of salt and other condiments to render it palateable.

By treating meat and flour in this way, an article is obtained extremely portable, capable of being preserved for a considerable period of time, and not liable to be attacked by weevil.

Claim.—The mode of treating animal and farinaceous substances by combining the nutritive properties of flesh, in the state of concentrated extract, with farina, flour, meal, or pulverized biscuit, and then baking or drying the same, to render them more convenient for use, and for the purpose of their better preservation.

WILLIAM IMRAY, of Milton-road, Liverpool. *For improvements in the manufacture of bricks.* Patent dated September 4, 1851.

These improvements have relation to the manufacture of bricks from pulverized clay or brick earth by compression, and consist of an arrangement of machinery for effecting this object, in which the necessary pressure on the brick earth in the moulds is produced by cams acting on sliding pistons fitting into the sides of the moulds. The moulds and their appendages revolve horizontally around a vertical spindle, and receive the brick earth in their revolution from a hopper placed above.

Claim.—The mode described of combining mechanical parts into a machine for manufacturing bricks.

JOHN POAD DRAKE, of St. Austell, Cornwall. *For improvements in constructing ships and other vessels, and in propelling ships and other vessels.* Patent dated September 4, 1851.

The "improvements in constructing ships and other vessels" have relation to vessels

built of wood alone and of iron and wood combined, and are principally based on a former patent granted to Mr. Drake.

The "improvements in propelling" have relation to a method of adapting the extent of immersion of the floats of paddle-wheels to the immersion of the vessel under light and heavy loads; and to the construction of paddle-wheels of the "feathering" and drum class, the latter being made hollow to assist in floating the vessel in case of emergency.

RECENT AMERICAN PATENTS.

(From the *Franklin Journal.*)

FOR AN IMPROVEMENT IN CARD GRINDERS. *Richard Kitson.*

Claim.—What I claim is, an instrument for grinding or sharpening wool, cotton, or other cards, made with sectorial card teeth, which are so bent at the heel as to make the sharp edge more prominent than its opposite and broad edge, together with its application to the card that is to be ground, in such a direction as to cause the sharp edge of the teeth of the grinder to be first presented to, and enter among the teeth of the card.

FOR AN IMPROVEMENT IN DAGUERREOTYPE APPARATUS. *W. Lewis, W. H. Lewis, & J. Lewis.*

Claim.—We claim, first, the construction of a camera-box, with a cross opening or mortise, to receive a sliding frame, that carries both an object glass and the daguerreotype plate, as described.

Second. The construction and application of a sliding frame with a division to receive a frame carrying an oblong object glass, so formed as to be placed either vertically or horizontally, as described and shown.

Third. The construction of the slide so as to receive, in the other division, a daguerreotype plate in a frame, such frame being pressed in place by springs, and held in place by blocks taking notches in the frame, as described and shown.

FOR AN IMPROVEMENT IN SIZING AND DYEING YARNS. *Alonzo Bascom.*

Claims.—First, the conducting of yarn or thread, from section or warper beams, directly into and through the size or colouring liquids, to the pressure rollers, by a series of rollers, more or less in number, placed as nearly in contact with each other as the nature of the case will admit, the closer the better, sufficient space being allowed between the fixed rollers for the passage of the yarns or threads, thus enabling the said rollers to operate as guides to each and all the threads, to prevent them from matting or clinging together, and superseding the otherwise necessary use of reeds, raddles, or other separators.

Second. I claim the taking or making of a weaver's lease, or series of leases, at the commencement of the process of warping or beaming of yarn or thread on section or warper beams, and at proper intervals on the same, to correspond with required lengths of yarns or threads on weaving beams, and preserving the same throughout the sizing and drying; thus dispensing with the use of hacks, or lease takers, in the dresser, and the otherwise necessary stoppage of the dresser or sizer, for the purpose of tying or twisting together each separate thread.

FOR IMPROVEMENTS IN PRINTING-PRESSES. *Thomas H. Dodge.*

The nature of my invention consists in hanging the platens and type beds of printing-presses on cranks on parallel shafts, which are so arranged that the platens and type beds are always parallel, or nearly parallel to each other, during the revolutions of the shafts.

Claims.—Having thus fully described the nature, construction, and operation of my invention, I will proceed to state what I claim:

First. Hanging the type bed and platen upon cranks on rotating shafts, arranged and operating in the manner substantially as herein described.

Second. The spring presser attached to the type bed, or platen, for the purpose of pressing the band, communicating motion to the sheet, against the opposite surface of the platen or bed, and causing it to be moved at precisely the same speed as the bed and platen, substantially as described.

Third. The arrangement for carrying and giving motion to the inking roller, consisting of the barrel, the bars, the lever springs, and band, combined together and with the above type bed and platen, in the manner substantially as set forth.

FOR AN IMPROVEMENT IN RAILROAD CAR WHEELS. *Nehemiah Hodge.*

My invention consists in making a car wheel in not less than two concentric parts, and connecting these parts by vulcanised India-rubber or other analogous elastic material interposed between them, whereby the annular or outer part of the wheel is insulated from the central or inner part, by a substance that will not transmit vibrations from the rim to the centre or axle of the wheel, whether such vibrations be lateral or radial in direction.

Claim.—What I claim as my invention is, connecting the tread or rim of a car wheel to the hub or central part thereof, by means of India-rubber or other analogous elastic material, such elastic material being connected with the outer periphery of the cen-

tral part of the wheel by a groove on the latter or its equivalent, and to the inner periphery of the rim also by a groove thereon, or its equivalent; the India-rubber holding itself in both grooves by its elasticity, and giving to the wheel lateral as well as radial elasticity, as herein described.

I also claim the grooved segments, constructed substantially as herein described, and interposed between the India-rubber and the rim, for the purpose of facilitating the insertion of the India-rubber into the space between the rim and central part of the wheel, and its removal therefrom, as herein set forth.

For Improvements in Railroad Switch. *David F. Phillips.*

Claim.—Having thus described my invention and improvements in the self-adjusting and locking switch for railroads, I wish it to be understood that I am aware that the relative position of the switch with the main track, or turnout, or sideling track, has been changed by the action of mechanism attached to the cars, as well as by devices attached to the locomotive in various ways; and therefore I do not claim changing the switch by apparatus or devices actuated by the cars or locomotives; nor do I claim constructing and operating a switch composed of a single moveable section of the main rail; but what I do claim as my invention and improvement is, the employment of the additional moveable sections in combination with the sections forming the switch, whereby the lateral movement of each is halved or divided in opposite directions, and a more regular curve is produced than that resulting from the use of the single moveable section or switch, and thereby insuring safety—the weight of the train of cars on one section of the switch forming a lock to the other section, as one section cannot move without the other till the train of cars shall have passed therefrom, as herein fully set forth. I also claim the combination of the double central lever bars with the central connecting rock shaft, having two cranks projecting in opposite directions, to which are attached the cross bars for uniting the double sections, whereby the switch is adjusted, as fully set forth and shown in the drawings.

For an Improvement in Wires for making Pile in Woven Fabrics. *Erastus B. Bigelow.*

The nature of my invention consists in combining with the flat pile or figuring wire employed in the weaving of looped or piled fabrics, and attached to one end thereof, a weight projecting from the lower edge, so that when such wires are deposited in the open shed of the warps, and during the operation of beating up with the lay, the preponderance of the said weight will retain the wire in the proper position.

Claim.—I do not limit myself to any particular form or mode of attaching the weight, as this may be variously modified. What I claim as my invention is, combining with the flat pile or figuring wire employed in weaving looped or piled fabrics, and attached to or near one end thereof, a weight, for the purpose, and in the manner substantially as described.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Alexander Parkes, of Birmingham, for improvements in separating silver from other metals. March 8; six months.

Edward Moseley Perkins, of Mark-lane, London, for improvements in the manufacture of cast metal pipes, retorts, or other hollow castings. March 8; six months.

James Graham, of Camden-grove, Peckham, Surrey, for improvements in treating ores containing zinc and the products obtained therefrom. March 8; six months.

James Wanbrough, of Albert-road, Mile-end, manufacturer, and William Allen Turner, of Fish-street-hill, London, merchant, for improvements in the manufacture of flocked fabrics. March 8; six months.

Frederick George Underhay, of Well's-street, Gray's Inn-road, engineer, for improvements in apparatus for regulating the supply of water to water-closets and other vessels, and in taps or cocks for drawing off liquids. March 8; six months.

Enrico Angelo Ludovico Negretti and Joseph Warren Zambra, both of Hatton-garden, London, meteorological instrument makers, for improvements in thermometers, barometers, gauges, and other instruments for ascertaining and registering the temperature, pressure, density, and specific gravity of aeriform fluids and liquids, or solid bodies. March 8; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in machinery for combing wool and other fibrous substances. (Being a communication.) March 8; six months.

George Wright, of Sheffield, and also of Rotherham, York, artist, for improvements in stoves, grates, or fire-places. March 8; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in propelling vessels. (Being a communication.) March 8; six months.

Joshua Crockford, of Southampton-place, Middlesex, gentleman, for improvements in brewing, and in brewing apparatus. March 8; six months.

Augustus Turk Forder, of Leamington Priors, Warwick, solicitor, for an improved fender. March 8; six months.

Richard Archibald Brooman, of the firm of J. C. Robertson and Co., of Fleet-street, London, patent agents, for improvements in presses and in pressing. (Being a communication.) March 8; six months.

Charles Augustus Preller, of Abchurch-lane, London, merchant, for improvements in the preparation and preservation of skins, and animal and vegetable substances. (Being a communication.) March 8; six months.

Uriah Scott, of Grove-street, Camden-town, Middlesex, engineer, for improvements in wheels and in springs, and spring-bearings for carriages. March 8; six months.

John Henry Johnson, of Lincoln's-inn Fields, Middlesex, and of Glasgow, for improvements in weaving carpets and other fabrics, and in the ma-

chinery or apparatus employed therein. (Being a communication.) March 8; six months.

Walter Young, of Springfield Ironworks, Salford, Lancaster, millwright and engineer, for an improvement or improvements in steam engines. March 8; six months.

Alexander Cuningham, of Glasgow, Lanark, North Britain, ironmaster, for improvements in the treatment and application of slag, or the refuse matter of blast furnaces. March 8; six months.

William Pidding, of the Strand, Middlesex, gentleman, for improvements in mining operations, and in the machinery or apparatus connected therewith. March 8; six months.

Peter Van Kempen, of West Ham, Essex, accountant, for an improved refrigerator to be used in brewing, distilling, and other similar useful purposes. (Being a communication.) March 8; six months.

William Willcocks Sleigh, physician and surgeon, of London, for a counteracting reaction motive-power engine. March 8; six months.

Alexandre Hediard, of Rue Taitbout, Paris, gentleman, for certain improvements in rotary steam engines. March 8; six months.

Paul Rapsey Hodge, civil and mechanical engineer, of Adam-street, Adelphi, Middlesex, for certain improvements in the construction of railways and railway carriages, parts of which are applicable to carriages on common roads. (Being a communication.) March 8; six months.

Thomas Ellison, of Queen's-road, Pentonville, Middlesex, painter, plumber, and glazier, for certain improvements in the manufacture of imitation marbles, granites, and all sorts of stones. March 8; six months.

Pierre Henri Bareau, of Paris, manufacturer, for certain improvements in the manufacture of carpets, velvets, and other fabrics. March 8; six months.

William Smith, of Park-street, Grosvenor-square, civil engineer, and Archibald Smith, of Princes-street, Leicester-square, engineer and machinist, for certain improvements in electric and electro-magnetic telegraph apparatus, and in the machinery for and method of making and laying down submarine, submerged, and other such lines. March 8; six months.

Colin Mather, of Salford, Lancaster, machine-maker, and Ernest Rolffs, of Cologne, Prussia, gentleman, for certain improvements in printing, damping, stiffening, opening, and spreading woven fabrics. March 11, six months.

Benjamin Goodfellow, of Hyde, Chester, engineer, for improvements in boilers for generating steam. March 11; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
March 4	3160	J. C. Stokes	Birmingham	Tap.
5	3161	G. Fletcher, and Co.	Wolverhampton	Metallic lath for beds, sofas, couches, &c.
,,	3162	H. Swift	Ipswich	Gutter or water-channel for footpaths and ways.
,,	3163	P. Pearson	Manchester	Machine for folding paper bags.
,,	3164	W. Austin	Farnham	Set of bricks for building walls, &c.
6	3165	H. Kenyon	Liverpool	Fluted mill-tooth.
,,	3166	J. Kealy	Oxford-street	Knife for turnip-cutters, &c.
8	3167	H. Jones	Birmingham	Measuring tap.
,,	3168	J. Finlay	Glasgow	Induction Ventilator.
9	3169	G. Benda	Basinghall-street	Fastening for Porte Monnaies, and other articles.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

March 6	372	J. Bedford	Seacombe, Chester	Ascending & descending friction and antifriction roller blind pulley.
11	373	J. G. Wilson	Chelsea	Rotary advertising vehicle.

CONTENTS OF THIS NUMBER.

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LEAKE'S PATENT IMPROVEMENTS IN MANUFACTURING SALT.

Fig. 1.

Fig. 2.

Fig. 3.

LEAKE'S PATENT IMPROVEMENTS IN MANUFACTURING SALT.

(Patentee, Mr. John Simpson Leake, of Whitehall Salt Works, near Sandbach, Chester. Patent dated September 18, 1851. Specification enrolled March 18, 1852.)

Specification.

My invention consists of an improved arrangement of machinery or apparatus, whereby the process of manufacturing salt from brine is greatly accelerated, and the labour attending the same also much reduced. Fig. 1 of the annexed engravings exhibits a plan, fig. 2 a side elevation, and fig. 3 an end elevation of this improved arrangement. A A is a salt-pan of the ordinary construction; B B rails placed between the pans; and C C a hurdle or truck, with perforated floor or bottom, which runs on wheels on the rails B B, and has hinges at D D to enable it to be tilted over at the end of each traverse of the pan. The hurdle or truck is loaded with salt, and then drawn or pushed along the rails (the pan being exposed as usual to the action of fire) during which, part of the brine returns still in a state of hot solution into the pan, through the holes in the floor or bottom of the hurdle, while the remainder, or all that attains the concentrated state in the course of each traverse of the hurdle, is on its arrival at the opposite end of the pan, shot into warehouse boats or trucks placed there for its reception. No heat is thus wasted in partial or imperfect evaporation of the brine, and nearly all the labour at present incurred in shifting the salt by barrows and other means is avoided.

And having now described the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim as my invention, in relation to the manufacture of salt from brine, is the passing of the materials over the top of the pans by means of wheeled or other trucks or hurdles running on rails placed for that purpose between the pans, and having perforations in the floors or bottoms thereof, through which part of the brine is returned in a state of hot solution into the pans, while the remainder or all that attains during each traverse of the hurdle, in the concentrated state,—that is the salt,—is carried forward and discharged into the warehouse boats or trucks.

ON THE USE OF ELECTRO-MAGNETISM ON RAILWAYS.

Galvanism has, of late years, become of considerable importance in the arts, and its use appears likely to become still more extended. It is employed, for instance, for telegraphs, electro-plating, and even for medicinal purposes: it has the property of imparting magnetism to iron, and, far different from the common magnet, the attraction of electro-magnetism is one of great force. If a bar of soft iron be coiled with copper wire, and a current of galvanism passed along the wire from even only a moderate-sized battery, it will impart such force of attraction to the iron as to cause it to suspend a weight of 2,000 lbs. or 3,000 lbs.—that is, a weight of a ton, or upwards. This appears a great power, and obtained at but a slight expense. It is not surprising, therefore, that the idea should have been entertained of obtaining a moving power from it: and, indeed, several engines have been constructed in different countries on the principle of intermitting the galvanic current, and many of which may be found described in the pages of this Magazine. But though partial success has attended these efforts, the engines as yet have been of only small power, and it remains to ascertain the comparative expense.

One of the chief causes of the delay, danger, and loss that are still found to accompany railway management, is the frequent slipping of the driving wheels from various causes. That this is a source of delay is an almost every-day experience; for a shower of rain may render the rails so slippery, that even an engine quite capable of otherwise drawing its load, is delayed thereby. That it may be productive of danger is proved by the serious accident that occurred on the Chester Junction line, just previous to the opening of the Exhibition. And that there is loss is evident—for there is just the same escape of steam as if it were exerting its power. To remedy this defect has doubtless engaged attention, and it is for this purpose I would

propose to employ electro-magnetic attraction. By coiling copper wire around the spokes, and perhaps the felloes of the driving wheels, and passing along them a galvanic current from a battery placed on the tender or near the engine, the driving wheels might be converted into powerful electro-magnets, that would draw to the rails with a force, if necessary, of several tons; and with this great advantage—that though the attractive power would be equal to the increased weight of the engine, there would be no actual increase of pressure on the permanent way. The force of this attraction would also admit of being regulated, so that it might be increased, as in ascending an incline, or diminished, as on the more favourable gradients. This would be a great improvement on the present system of having the same heavy engine to pass over all parts of the line, favourable and unfavourable. The adhesion of the wheels to the rails also would increase the safety, as the engine would be still less liable to leave the rails than at present; less care would also be necessary in taking the curves, &c.; and if a sudden stoppage were required, the attraction might be increased, so that were the engine reversed, the wheels would have a powerful hold on the rails. Were the battery strong enough, the attraction might be increased to such a degree as almost to counteract even the power of the engine.

Railway engines are constructed of great weight, in order that the wheels may have a proper hold when in motion; but as magnetic attraction would answer the same purpose as gravity, they might be constructed much lighter than at present. This would enable the rails also to be made of less substance, as the present strength is entirely for the sake of the engine, and not at all necessary for the carriages and trucks, &c.

Besides the attractive power, magnetism can also be made to repel with the same force with which it can attract, and this property may come to be of even still greater benefit. Suppose, for instance, a truck loaded with goods to the weight of ten tons, and that by means of copper coils around the spokes, &c., of the wheels, a galvanic current be passed along them, and they be made to repel from the rails with a force—say of nine tons—this would leave but little more than one ton still resting on the rails, and greatly ease the load to be drawn by the engine. A horse can draw a load of one ton on a good road, ten tons on rails, and in still water, as on a canal, it may draw fifty tons. Magnetism is a far more subtle fluid than water; and if the power of a horse suffice to draw fifty tons in the latter element, it is not impossible it might draw a far greater weight in the fluid of magnetism. This employment of the magnetic fluid might also give a greater control over the train; for were any immediate stoppage required, the withdrawal of the magnetic current would cause such an enormous accession of weight as might render the power of the engine nugatory; or the magnetism might even be changed from repellent to attractive. This use of such great power would probably require caution—the great benefit doubtless being the reduction of expense; though there is reason to think it might be made to contribute to the greater safety of railway transit.

This application of electro-magnetism for the purpose of increasing and diminishing the friction of a train, appears more feasible than any attempt to obtain motive power; for the attractive power of the magnet diminishes so rapidly, at even but a small distance. And though this method does not produce motion, the reduction of friction may be regarded as equivalent, if not superior to the production of power. If the system of rails reduce the friction to one-tenth of what it is on a good highway, so that a horse can draw ten times the load on the former that it can on the latter, and should magnetism be found to reduce it still further in a similar, or even half proportion, then the same power of a horse would suffice to draw 50 or 100 tons. The magnetic repulsion may, indeed, be carried so far that the wheels of the train would not rest on the rails at all, but lie some quarter or half inch above them; and when in motion, they would be passing not on iron, but on magnetism. By this means, the friction would probably be reduced to a mere fraction of what it is at present, and the passage of the train rendered noiseless and easy. It may, indeed, perhaps be found better to apply the repellent magnetism to the rails instead of the wheels. The principle may also, perhaps, be

adapted to machinery in general, to mills and mines, and steam vessels. It might, for instance, be applied to bearings and the axles of wheels; where, besides lessening the expense, it may save oil. Bearings are generally made of brass, and may not the superiority of this metal be partly ascribed to the probable galvanic action arising from the combination of the two metals of which brass is compounded?

M. G.

MEMOIR OF THE LATE J. H. SWALE. BY T. T. WILKINSON, ESQ., F.R.A.S.

Part III.

(Concluded from p. 209.)

In 1821, Mr. Swale published the first part of his "Geometrical Amusements," which had been announced at the close of one of his solutions in the *Leeds Correspondent*. It contains a "General Problem and Solution, with its Application to a Series of Geometrical Inquiries; to which is added a great variety of Problems for subsequent Exercises;" and is dedicated "To John Leslie, Esq., F.R.S.E., and Professor of Natural Philosophy in the University of Edinburgh ...... as a public testimony of esteem for his worth as a MAN, and for his distinguished talents as a GEOMETER; by the Author." The *second* and *third* parts were announced as "*ready for the press;*" but, for reasons which have elsewhere appeared, were never published. To give a just idea of the extraordinary merits of this now extremely scarce work, it would be necessary to institute a comparison between it and the writings of Simson and Stewart, since the works of no other English geometers, those of Thomas Simpson, perhaps, alone excepted, will bear any comparison with what their author thought proper to term "Geometrical Amusements;"—an inquiry which cannot be attempted on the present occasion. Suffice it to say, that its *originality* and *usefulness* have been acknowledged by all who have had an opportunity of examining the work, whilst the methods of treatment, the fertility of invention, and the almost *unique* elegance of the analyses and constructions, have placed Mr. Swale in the first rank amongst the cultivators of the ancient geometrical analysis. The late Professor Davies, than whom no one was better able to judge, has frequently borne his testimony to the originality and excellence of Mr. Swale's geometrical writings. In his "Solutions to Hutton's Course of Mathematics," he omits an intended essay on the analysis of the ancients, and contents himself by referring the student to the principal English mathematical periodicals, amongst which he enumerated the *Leeds Correspondent* and Swale's *Liverpool Apollonius*, but, "above all," he would "direct his attention to the *most remarkable book of modern times*—"Swale's Geometrical Amusements"—as one from which he will acquire more power of original research than from any work [he] could place before him."—("Davies's Solutions," p. 343.) The same distinguished writer has again occasion to recur to the subject in the "Historical Notices respecting an Ancient Problem" (*Mathematician*, vol. iii., p. 317), when he further states that "a tolerably familiar acquaintance with the works on geometry which have been published in this country during the past and present century, has led to my conviction that Mr. Swale was the most independent and original geometer of his time. Everything he wrote was more free from the impress of the writings of others, even where the subjects are the same; and so elementary, too, that we should hardly suppose it possible for two different methods to be proposed, than I find to be the case with any other geometer, except Dr. Matthew Stewart. Swale's geometry, in fact, was his own invention; and I have been informed, by a mutual friend of his and mine, that he was singularly unacquainted with the writings of other geometers, even of the English school. His 'Geometrical Amusements' is, undoubtedly, one of the most original and remarkable books on geometry that has appeared since the time of Stewart and Simson." Strongly expressed as these disinterested eulogiums may appear to some, it is not too much to say that they are by no means exaggerated: his *published* works fully justify the terms made use of in attempting their description, whilst those still remaining in MS. present ample proofs of a genius in geometry which has seldom been surpassed. An imperfect account of some of the latter has recently been furnished by Professor

Davies, in a paper ("Geometry and Geometers," No. VII.) which will probably, in due course, be presented, with additions, to our readers, and in which will be found his *latest* opinions on some of the leading characteristics of the "Amusements." Had the author of this series of papers been spared a few years longer, he would have completed those interesting notices, and have rescued many a deserving name from unmerited oblivion; but Providence ordained it otherwise, and we must bow to its decrees. It is, however, pleasing to reflect that whilst grappling with the cold hand of death, Mr. Davies's last efforts were directed towards elevating a kindred spirit to its true position in the temple of fame.

The *Liverpool Apollonius*, whose contents are already in part transferred to the pages of this Journal, was published by Mr. Swale in 1823 and 1824, but partly in consequence of the admission of a series of "Letters on the Newtonian System, by Mr. Bartholomew Prescott;" where the Newtonian system of astronomy is attacked and ridiculed with little science and less judgment; this otherwise valuable periodical was discontinued with considerable loss, and is at the present time extremely scarce and comparatively unknown. It ought to have been acknowledged that Questions 381, 382, 383, 384, in the *Educational Times* are taken from the *Apollonius*, and enough of its other contents has already been printed to justify the assertion that "its geometry is of a very high order, and worthy of the most careful study." The papers on the tangency of circles, and on polygons inscribed in circles or in other polygons, are masterpieces of geometrical research. (*Davies's Geom. and Geometers*, No. VII.)

As previously intimated, Mr. Swale removed from the "semi-barbarians at Idle" to Liverpool, about the year 1810, where he established "Brunswick-place Academy," and soon became one of the most popular teachers in that busy scene of commercial enterprise. He here formed the acquaintance of Colin Campbell, author of "Mathematical Lucubrations;" William Hilton, editor of the *Student;* William Marrat, author of "Mechanics," and "Mechanical Philosophy," editor of the *Boston Enquirer*, *Mathematical Miscellany*, &c.; Rev. G. W. Wilding, author of a "Geometrical Treatise on the Conic Sections;" besides that of Messrs. George Duckett, E. S. Eyres, Samuel Jones, Griffith Jones, William Smith, &c.; all well-known contributors to the mathematical periodicals of the time, and forming together one of the most brilliant constellations of geometrical talent ever collected in a provincial town. The onerous duties of a large academy, however, added to the wear and tear of a youth spent in the same laborious avocations, soon produced their usual effects upon Mr. Swale's constitution; and although naturally robust and strongly built, his nervous system became so shattered that he was compelled to give up his establishment in 1823. Brunswick-place Academy was still in a flourishing condition when this unfortunate circumstance occurred, and as it had been the means of providing a competency for Mr. Swale, it possessed a high mercantile value, and might have been disposed of for a considerable sum; but he had conscientious scruples respecting the *propriety* of such transfers; and, besides, he was not the person to dispose of his conscience for a consideration; hence "some of his peculiar notions prevented him from disposing of his school, which he might have done to advantage."—(*Private Letter.*) The derangement of his nervous system continued to affect him at intervals for a period of seven years and upwards, when he was somewhat restored, but his bodily energies were much reduced. On his partial recovery, he occasionally undertook to instruct a private pupil in mathematics, and being well-known in the town at that time, he might have had many such, but he declined to extend his connections, and amused himself by "spinning his cobwebs," as he facetiously termed his speculations in geometry (*ibid*). Undoubtedly his recovery would have been much more rapid, had he not in an unguarded moment advanced about 1,200*l.*, *without security*, to a near relative, who subsequently defrauded him of the whole amount. His own notions of the mutual obligations existing, or which *ought* to exist, between debtor and creditor would have been sufficient to have induced him to repay any amount with which he might have been entrusted without the aid of a legal instrument to enforce the

demand, and it seems he fondly hoped the same principles of rectitude would lead others to adopt a similar course. In this, however, he was mistaken:—the "*dishonest relative*" never repaid a single farthing of either principal or interest, and now, in declining years, and with enfeebled energies, Mr. Swale found himself considerably reduced in his worldly circumstances. The effect of this untoward occurrence upon his general health may easily be conceived, and his MSS. contain several memoranda indicative of his strong feelings on the subject when casual circumstances led him to revert to his extensive losses. On the "5th May, 1828," he says, "I do very little now. The poverty to which I and *my children* are reduced by plundering *villains* has prostrated all my enjoyments and hopes! I have toiled for 83 years, and at 53 (years of age) am destitute." On another occasion he exclaims, "Oh! divine Geometry! How transcendantly beautiful are the gems of thy inexhaustible treasury! But for thy pure perennial pleasures, the swindling spirit of the world would long ago have broken my heart!" Throughout the whole of these and similar notices, Mr. Swale evinces far greater anxiety for his *children's* welfare than regret for his own individual privations; in this respect he exhibited a model of parental affection which was rewarded by a corresponding interchange of filial duties. "The main feature of his character was *sincerity*, and he ever spoke the sentiments of his mind on any subject under discussion. His disposition was kind and generous, and his temper cheerful and unsuspicious. When in the vigour of manhood he was robust in health and body, and scarcely ever experienced a day's sickness before he attained his 45th year," (*ibid*). After this period an habitual tendency to depression of spirits occasionally dimmed the lustre of his declining years; yet his active mind does not seem to have relaxed its efforts to any considerable extent. Most of the existing MSS. bear dates subsequent to his affliction, and his favourite study appears to have furnished him with a never-failing source of pleasure. What to most proves really a severe mental discipline, was pursued by Mr. Swale as *recreation*, for he endorses a portion of one of his latest MSS. as "*Geometrical Amusements*, to soothe an incurable despondency." During the latter years of his life his health and spirits were in a great measure restored, and he occasionally relieved the monotony of the town by making short excursions into different parts of the country for change of air and the enjoyment of rural scenery, of which he was remarkably fond. In these excursions he renewed the personal acquaintance of many old associates, amongst whom the names of Messrs. Shepherd and Whitley, two of our ablest remaining Geometers, are frequently mentioned in the memoranda relating to these exhilarating rambles. Recreation and his favourite study continued thus alternately to occupy his time until the 13th of January, 1837, when his earthly career was terminated by an attack of influenza, in the 62nd year of his age, and his remains lie interred in a picturesque burial-ground named "The Necropolis," situated at West Derby, in the vicinity of Liverpool.

Burnley, Lancashire, March 7, 1852.

Erratum.—Page 208, col. 1, line 1, bottom, for "in his letter to Mr. Whitley," *read*, "in his notice of Mr. Nicholson's question."

THE COMMON MUSKET ADAPTED TO RIFLE-SHOOTING.

Sir,—It was suggested (in the *Times*) by a correspondent, that our old musket barrels should be rifled to throw a Minié ball with accuracy to a range of 800 yards.

This alteration would be expensive, and attended with danger; the barrels are not stout enough to bear the rifling process, and to supply our troops with new muskets would involve a large outlay.

I am induced to believe, from a long series of practical experiments, that the musket can be made to shoot well at the range of 800 yards. To accomplish this, I reduce the weight and length of the regulation musket, by cutting the barrel to 2 feet 8 inches; with this more convenient weapon, I use a hollow cylindrical bullet cast similar to a Minié ball, but increased in length to 2¼ diameters of the bore, and hollowed to three-fourths of the length, placing the centre of gravity well forward. The conical point is grooved, as a spiral screw; this produces

a rotary motion on its axis when propelled through the air, with the truthful flight of a rifle ball. Another advantage of this projectile is that of the hollow chamber being made to contain the exact weight of gunpowder required (secured from damp by a circle of thin gutta percha), and thus forming *ball and cartridge in one*, with which the soldier may fulfil the rule of Suwarrow, "keep your powder dry."

Captain Minié's interior iron cone is not requisite; the explosion expands the hollow cone, leaving no windage between ball and barrel.

Description of Engravings.

The above sketch exhibits the sort of bullet I make use of. A is a hollow cylinder; B, an interior powder-chamber; C, a conical spiral; and D, gutta percha cap, or disc.

I am, Sir, your obedient Servant,
GEORGE CARTER.

Nottingham-lodge, near Eltham, Kent,
February 26, 1852.

ON DYES AND DYE-STUFFS.

(From a Lecture by Professor Solly before the Society of Arts.)

There is, perhaps, no art which has undergone more important changes and alterations during the last half century than that of dyeing; and here, as in all other branches of applied science, we find many points of interest in studying the vegetable raw products employed, which are, as it were, the ores from which precious metal is to be extracted by the skill and knowledge of the manufacturer. Some of these changes were shown in a very interesting and instructive way in the Great Exhibition, where we had the rude, but efficient dye-stuffs of our ancestors, contrasted with the more elaborate processes and more refined dyeing materials of the present day; at the same time, it is impossible not to recognise the eminently progressive character of the art, which we may fairly anticipate will undergo as important changes in the coming half century as it has experienced during the past. To some extent we may form an estimate of the state to which the art has arisen in each country, by observing the dye-stuffs employed; and, in most cases, where woad, bugloss, and weld are the chief sources of blue, red, and yellow, we may safely conclude that comparatively little progress has been made in the application of practical science to the art of dyeing.

It would be foreign to our subject at present to enter at all into the operations of the dyer, and I shall, therefore, confine myself to the consideration of the materials of his art, quite independent of the manner in which he employs them. It is obvious that those dye-stuffs which require no preparation, but which, like logwood, fustic, and madder, are yielded by nature in a state fit for immediate use, are under very different circumstances from those which, like indigo, litmus, and annotto, undergo a process of preparation before they are fit for the market. But even in the case of those which seem to require nothing more than the axe of the woodman, very great and important differences are to be observed. Climate, soil, and cultivation produce the most marked differences in the growth of plants, and consequently also in the production of colouring matters. One illustration of this will perhaps serve as well as many, and will show not only how the production of dyes is regulated by apparently small circumstances, but also how those circumstances may be controlled and modified by the judicious application of science. It was observed that some of the madder grown near Avignon was inferior in the richness and brilliancy of its colour to that produced in other districts; and the proprietors being anxious to discover the cause, were led to institute a chemical examination of the soil of their own land, in comparison with that of some of the best madder farms: the result showed that their soil was deficient in lime, whilst all the others contained it. They were, therefore,

induced to give their land a good dressing of lime, and the result fully justified them; for the next year their crop of madder was inferior to none. The value of all these dye-stuffs depends on the care bestowed on their cultivation, and upon the attention paid to their collection and preservation, so that they may not suffer injury, either from carelessness or from adulteration. The importance of vegetable colouring matters generally is somewhat diminished by the numerous chemical discoveries which have introduced to the dyer mineral or inorganic substitutes for many of them; but, at the same time, chemical science has so greatly improved most of the processes of dyeing, that the dyer, by means of its aid, is now able to get many colours from the old vegetable dye-stuffs, which were quite out of the power of his predecessors. The improvements in calico-printing and dyeing in many colours have gradually given rise to a demand for new colours and new dyes, so that at the present time good or promising new colours are received with a considerable degree of interest. Fortunately, there are many of these, and not a few which may be had in large quantities, and at low prices.

Owing to the progress of the art, many colouring matters which a few years since were regarded as of little or no value, are gradually rising in estimation; when first introduced, they were tried as substitutes for the ordinary dye-stuffs, and were treated in the same way as those dye-stuffs commonly were; the result was far from promising, and they were accordingly condemned. Now, however, new modes of operating are introduced; the colouring matter is treated in accordance with the known laws of chemistry, and good and useful colours are obtained from it. Munjeet, chay root, and many other dye-stuffs, are in this manner gradually coming into use and estimation.

The advancements which have been made in the manufacture of mixed fabrics, call for corresponding changes and improvements in the art of dyeing, and render new modes of dyeing, as well as new dyes, highly desirable. A dye which serves well for wool or cotton, frequently will not take on silk or flax; and, consequently, though it will do very well for any one of these fibres alone, it is of little use for a mixed fabric composed of two different fibres. Amongst some of the little-known native dyes of India and other countries, there are many well deserving of careful examination; such, for example, as the black indigo of the Shan country, the black dye of New Zealand, and others.

Dye-stuffs, for the most part, are bulky and heavy substances, the carriage of which for any distance, by land, or even by water, makes a very serious addition to their cost; and, consequently, every mode of increasing the proportion per cent. of colouring matter is worthy of consideration; and those modes of preparation are best which yield the largest quantity of colour and the least quantity of useless fibrous matter. Owing to the judicious manner in which the Chinese safflower is collected, it contains far more of the fine red colouring matter, and is consequently worth four or five times as much in the market as the best Bengal safflower; in addition to which, from want of due care in the drying, the latter is sometimes so much injured during the sea voyage as to be deteriorated at least 50 per cent. The loss thus sustained is often set down to "the nature of the drug," and not to the careless habits of those employed in collecting it.

When we remember how many thousand tons of dyeing woods are annually imported, and how many thousand tons of it are absolutely useless woody fibre, we cannot help coming to the conclusion that here chemical science might be applied with great advantage, and that if colonists could be taught how to extract and concentrate the true colouring principles of these woods, much unprofitable labour and expense would be saved; nay, more, these concentrated dye-stuffs, might be profitably imported from places from which the cost of carriage would altogether prevent the importation of the dye-stuff in its raw state. This is a matter of great practical importance, and one which has not yet received that attention which it deserves; there are no doubt difficulties in the way, but after the many triumphs which science has achieved, we surely need not be deterred by any ordinary difficulties. The consideration of this subject naturally leads to one very closely connected with it, namely, the various substances used in tanning; in which, to some extent, the object just suggested has already been realised. The most experienced tanners all agree, that no substance has yet been introduced capable of replacing good oak bark in their art; but, at the same time, they readily allow that many substances are of great value as aids to oak bark, and in the preparation of particular kinds of leather. The number of astringent barks and woods suitable for this art is very large; but, with few exceptions, the cost of freight would prohibit their being brought from any distance; in such cases extracts have been made, and imported either in the dry and solid form, like catechu and kino, or as a thick solution, like the mimosa extract of

New Holland. The value of these extracts depends in a great measure on the mode in which they are prepared; they should be rapidly concentrated, and exposed as little as possible to the air during evaporation, or otherwise they suffer a considerable degree of decomposition, and their value is proportionably diminished.

METHOD OF ENGRAVING PLATES FROM NATURAL OBJECTS. BY FERGUSON BRANSON, M.D., CANTAB.

I venture to bring under the notice of the Society of Arts a short account of a new method of engraving plates for printing ferns, leaves, sea-weeds, and other flat plants. Some time ago, having taken in gutta percha some impressions of ferns, the singularly beautiful manner in which the exact character of the plant was transferred to the gum suggested to me the possibility of printing from the gutta percha itself, so as to produce on paper a *fac-simile* of the plant. The experiment partially succeeded, and curiously tested the elasticity of the substance; for the impression remained uninjured, after being subjected to the great pressure of a copper-plate roller. I say partially succeeded; for the printer found it impossible so thoroughly to cleanse the ink from the margin around the impression, as not to leave when printed a dirty stain on the paper. This involved the necessity of cutting away the dirty margin from the print, and pasting the impression upon clean paper, —a tedious and troublesome operation. The impressions thus produced are very accurate; but the process is valueless as regards multiplication of prints. It at once occurred to me that an electrotype copy would obviate the difficulty. This would allow the surface of the copper to be burnished; the printer would then be able to wipe the surface clean, and produce an unstained impression. This proved to be perfectly practicable. Those, however, who have amused themselves with taking electrotype impressions, know how tedious, troublesome, and costly it is to produce large and strong electrotype plates. This led me, after a few trials, to abandon the process. Having occasion to get an article cast in brass, I was astonished at the beautiful manner in which the form of the model was reproduced in the metal. I determined therefore to have a cast taken in brass from a gutta percha mould of ferns, and was much gratified to see the impression rendered almost as minutely as by the electrotype process; in some respects even better; for the granular nature of the sand on which the brass is poured gives a texture to the impression, which renders it better adapted to hold the printing ink; besides, the cast-metal plate being considerably harder than an electrotype plate, any number of impressions can be taken from it. The following is the plan adopted to produce the plates: A piece of gutta perch free from blemish, and the size of the plate required, is placed in boiling water; when thoroughly softened, it is to be taken out, wiped dry rapidly, and then laid flat upon a smooth metal plate, and immediately dusted over with the finest bronze powder used for printing gold letters. The use of the bronze powder is threefold; to dry the surface completely, to render the surface more smooth, and to prevent adhesion. The plant is then to be neatly laid out upon the bronzed surface, and covered with a highly polished metal plate, either of copper or German silver. The whole is then to be subjected to an amount of pressure sufficient to imbed the upper metal plate in the gutta percha. When the gutta percha is cold, the metal plate may be removed, and the plant gently withdrawn from its bed. From the beautiful impression of the fern left in the gutta percha, a cast in brass may readily be obtained in the ordinary method; viz., by pressing the mould into fine casting sand, and running the melted metal upon the raised impression in the sand; thus producing a sunken impression in the metal. This part of the process can only be performed by a professed caster of metal, and not by an amateur. As soon as the surface of the brass cast has been burnished,—of course, carefully avoiding the impression of the plant, —it is ready for the copper-plate printer. If the printer skilfully mixes the ink to the exact colour of the fern, a print is obtained scarcely to be distinguished from the plant itself. The novelty of the process consists in causing the plant, so to speak, to engrave itself, and also in the substitution of a cheap casting in brass for an expensive copper-plate engraving. Another and perhaps better plan of printing, but involving a little additional expense, would be to take an impression in lithographic ink; transfer it to one or more stones, so as to obtain greater variety of tint; and then make use of the brass cast as a die to emboss the flat lithographic impression. By this means a cleaner and sharper impression would be produced; and every line of the stalk, and every line of the leaf, would be preserved. I venture to lay this short account of my process before the members of the Society of Arts, in the hope that it may be found available for some forms of scientific illustration.

The paper was accompanied by specimens of the plates, and of impressions in inks of the colours of the various plants.—*Transactions of the Society of Arts.*

REGULATING PRESSURE TAP

(Registered under the Act for the Protection of Articles of Utility. Daniel Simpson, of Lancaster, Proprietor.)

Fig. 1. Fig. 2.

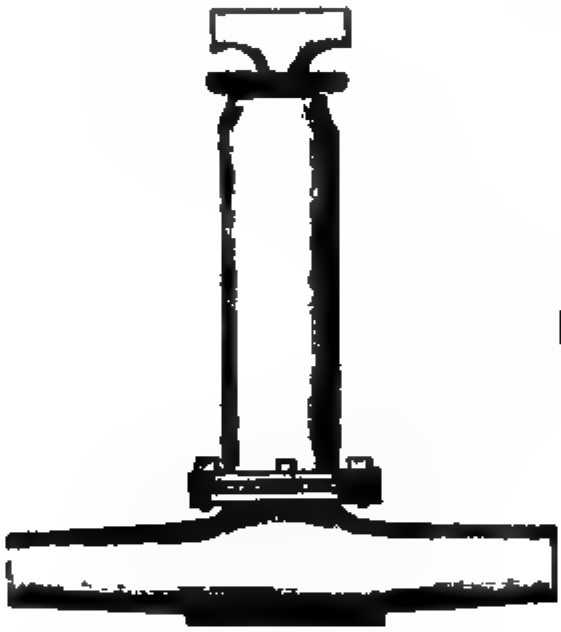
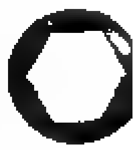


Fig. 3



Description.

Fig. 1 is an elevation, and fig. 2 a longitudinal section of this tap. A is the inflow, and B the outflow pipe; C is an upright barrel, a cross section of which is given in fig. 3, which contains a helical spring D, to the lower end of which is soldered the valve E, and to the upper end the nut F. G is a handle, which is prevented from moving up or down in the barrel, but when turned round either to the right or left, increases or lessens the pressure on the valve, by pressing down or drawing up the nut F. H is a stuffing box to prevent leakage. The tap is, of course, to be inserted in the line of pipes between the main and the pipes to be protected.

By turning round the handle G, the pressure of the water contained in that portion of the pipes placed within a house, or any district where high-pressure service is employed, may be regulated so as to protect the pipes from the danger of breakage.

IMPROVEMENTS IN ELECTRO-TELEGRAPHIC APPARATUS.

Sir,—The following improvements which seem to have escaped the attention of the *corps telegraphique*, will, I trust, find a place in your columns. The engravings will explain their nature; fig. 1 is a section of the coil in present use; fig. 2 an end view of the same; fig. 3 the needle in the position it occupies within the coil. The dotted lines on each side of the needles show the distance the wire is from the needle. The path of the needle is shown by the arc drawn from its centre. It is well known that the power of a magnet decreases as the square of the distance increases. Now, on reference to the engravings, figs. 1 and 2, it will be seen that the point of the needle (where the magnetic force is strongest) is a great distance from the centre of the coil, which is the point of its greatest power. The manner also in which the coils are made removes the most effective part of the coil to a great distance from the point of the needle, as will be seen by reference to figs. 1 and 2, where *a* is a piece of ivory generally about one-eighth of an inch thick, through which a brass screw passes, securing both sides together. If these pieces of ivory could be dispensed with, and the point of the needle were made to act as close to the wire as possible, we should then have the full force of the coil acting on it. But as they cannot be altogether dispensed with, they may be made much smaller, thereby bringing the wire nearer

the needle. It will also be seen that the farther the needle moves into the coil, the greater is the loss of power, as it moves on a centre, and consequently describing an arc, while the wire on the coil is wound in a right line across.

Fig. 2.

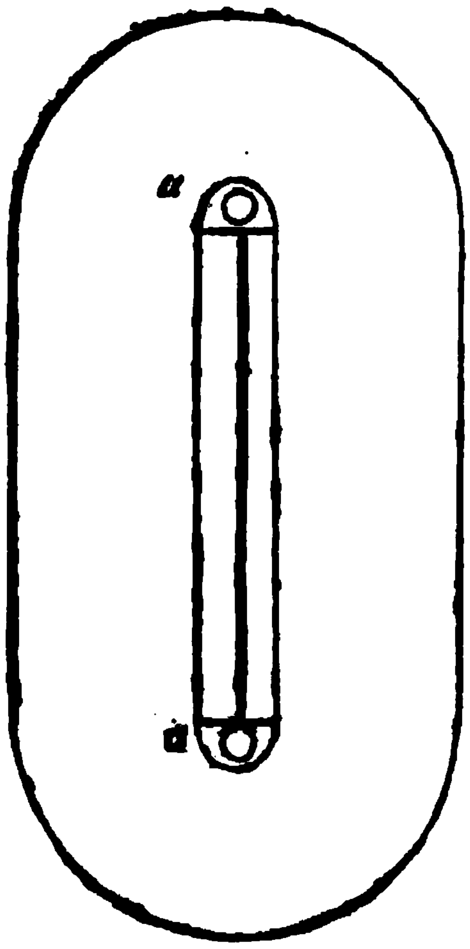


Fig. 1.

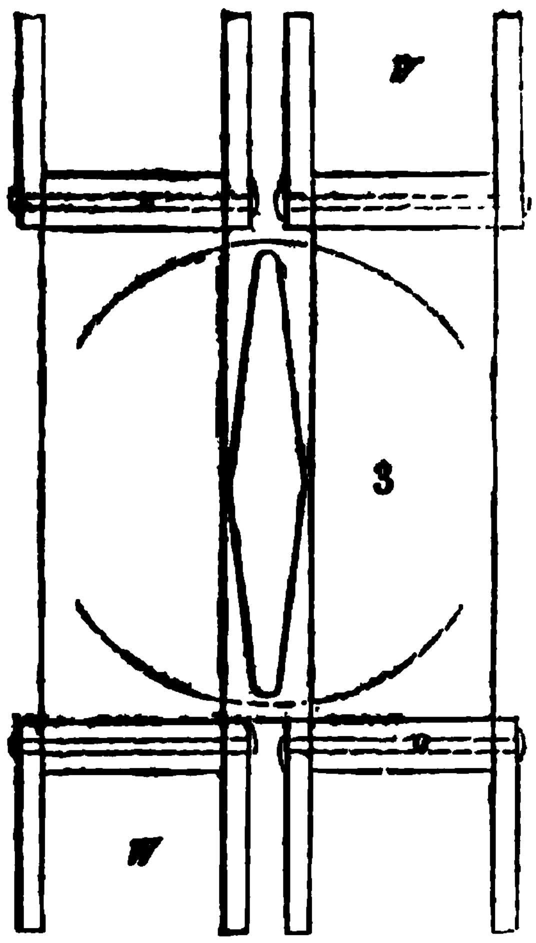


Fig. 4.

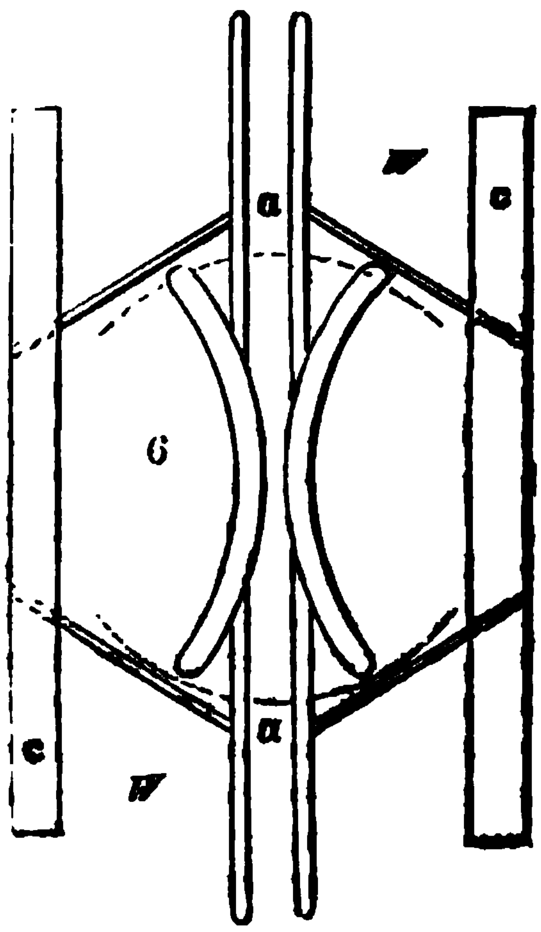
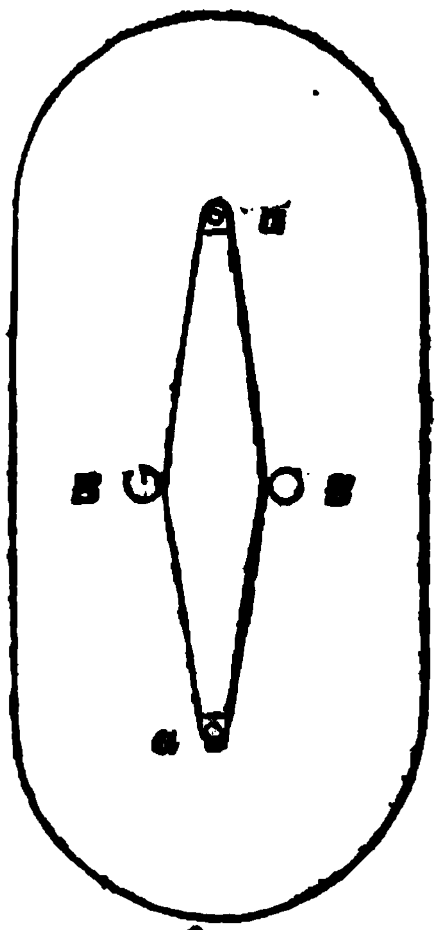
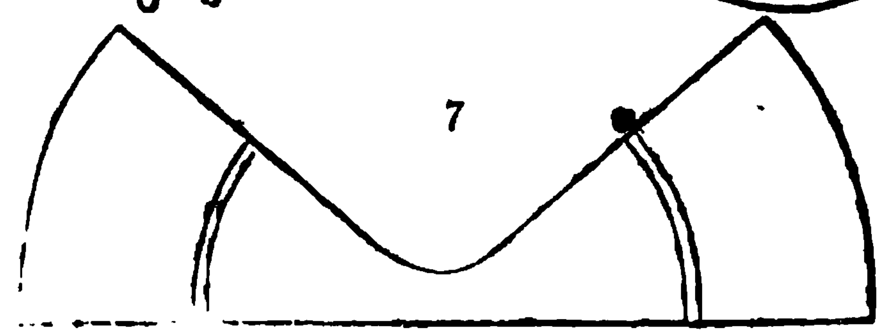


Fig. 5.





The remedy I propose will be seen by referring to figs. 4, 5, and 6. Fig. 4 is a section of the improved coil, where the wire, instead of being wound in a

right line, becomes contracted, following as near as possible the arc described by the needle. Fig. 5 is an end view of the same. The parts marked *a* are very small ivory pins, round which the wire is wound; BB′ are pieces of ivory, through which screws pass to secure the sides together. Fig. 6 shows the shape of the needles I prefer. I screw them with a very small screw to a thin collar, which is soldered on the axis.

It will now be seen that the point of the needle occupies the centre of each coil, and that the wire is as close to them as possible. When the needle is deflected, it is met at all points by nearly the same force, and that acting with great advantage.

I have made coils of the shape shown in fig. 7, but do not find them better than fig. 4.

If, Mr. Editor, I shall not intrude too much upon your valuable pages, I will, in a future Number, describe several improvements which I have made on Telegraph Alarms.

I am, Sir, yours, &c.,

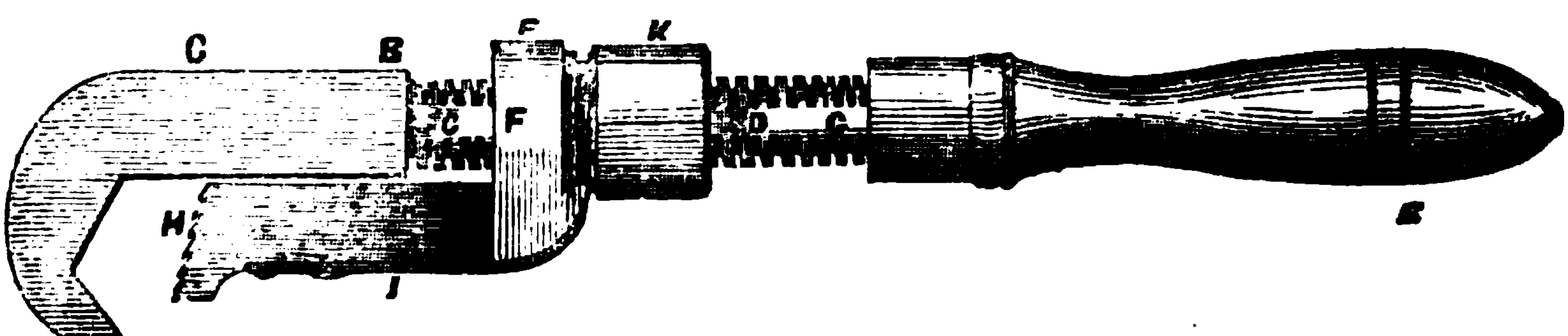
ALEX. MACKENZIE.

Superintendent of Telegraphs.

Edinburgh and Glasgow Railway-office,
Glasgow Station, March 1, 1852.

SCREW GAS TONGS OR WRENCH.

(Registered under the Act for the Protection of Articles of Utility. Edward Evans, of Brixton-place, Brixton-road, Ironmonger and Gas-fitter, Proprietor.)



Description.

The above engraving is a side view of this article, which is intended for holding pipes, coupling, &c., for forming joint connections. A is an angular-shaped jaw, which forms the termination of the stem B; the upper portion, C, of the stem is rectangular in its cross-section; the middle part D has a screw thread cut upon it, and the lower end is furnished with a handle E. F is a socket which is fitted upon the stem, on which it is free to travel up and down without, at the same time, being able to turn round on account of the two flat sides GG of the stem. H is a tongue or grip, which is hinged to the socket F; and I a spring which keeps the tongue pressed against the side of the stem. K is a nut which takes upon the screwed portion of the stem. The lower end of the socket F fits into a groove in the upper end of the nut K, so that when the nut is screwed up or down, it brings the tongue closer to or further from the jaw A.

STEAM BOILER EXPLOSION AT RICHMOND, UNITED STATES.

[The following is a report of a Committee of the Franklin Institute, to which was referred for examination the explosion of a steam boiler at the Factory of Messrs. I. P. Morris & Co., at Richmond, Pennsylvania.]

The boiler in question was of a cylindrical form, 5 feet in diameter and 16 feet long, having a fire-box at one end, from which three main flues, the largest of which was 20 inches in diameter, extended to the smoke-box, from which twelve return flues, 6 inches in diameter, carried the products of combustion to the chimney. Near the end of the boiler there was a steam dome 4 feet in diameter, which was placed over an opening of the same size in the shell of

the boiler. The iron of which the boiler was made, was of the best quality, 0·3 inches in thickness. This boiler was intended for the use of a steam boat, and was to be used under 100 lbs. pressure. The parties who ordered it required that it should first be tested under a pressure of 150 lbs. Upon this trial the fire was kept up, until the safety-valve lifted under a pressure of 148 lbs.; an additional weight was then added sufficient to give the requisite pressure of 150 lbs., and after a few moments, the experiment was considered as satisfactory, and directions were given to open the fire-doors; at this moment the explosion took place, killing one of the persons present, and severely injuring two others, one of whom has since died.

The boiler was torn into at least three pieces, by fractures perpendicular to the axis,—one of which (the fire-box end), was thrown forward, and came in contact with two large Cornish boilers which were lying in front of it, indicating by its effects upon them the terrific violence with which it had been projected. The waist of the boiler was torn from the steam dome, ripped open, and flattened out upon the wharf where it lay, while the steam dome and other portions, were thrown high into the air, and fell into the Delaware river, whence they have not been recovered. The main flue was also separated from the rest and thrown into the dock, whence it was afterwards recovered and found flattened, but apparently not collapsed by the pressure of the steam.

In seeking to account for this explosion, we may in the first place remark, that there appears no reason whatever to suspect the existence of a low-water level. The experiment had been but a short time in progress, no water or steam had been lost, except that which was blown off at the safety-valve, nor was any pump in connection with the boiler by which cold water might be thrown upon an exposed and overheated surface. This, then, the most common of all causes of explosion of steam boilers, cannot be reverted to, to explain this one.

Nor is there any reason to suspect carelessness or recklessness on the part of those in charge of the experiment, nor negligence or mistake in the calculation of the pressure on the safety-valve. The boiler was at the time under the charge of perfectly competent persons, who were under no excitement, had no inducement to rashness, nor were under circumstances likely to lead to over haste, and whose lives were, as the result too sadly proved, exposed in the event of an explosion.

The Committee submitted to the proof of the breaking-apparatus pieces of the iron taken from the edges of the fractures, and the results showed that the iron was of good quality. The following are the breaking weights per square inch of section, of these pieces:—

Iron taken from the side of the boiler;	with the fibre, 67·200 lbs.;	across the fibre, 67·200 lbs.
" " shell	" " 50·400 "	" 56·000 "
" " flues	" " 53·760 "	" 54·880 "

If from these data, and the diameter and thickness of the shell of the boiler, we calculate its strength, and compare it with the effort exerted upon the shell by a pressure of 150 lbs. per square inch, we shall find that after making all possible allowances, a simple cylindrical shell of such diameter and thickness, and made of such materials, would have been fully equal to the strain brought upon it. But when we consider the effect of the large opening made into the steam dome, we shall see that the strength of the cylinder was very materially diminished, and probably brought below what was necessary to resist the strain upon it.

It will be easily seen that the effect of such an opening thus covered must be to bring a greatly increased strain upon its edge where it intersects the upper line of the shell, while the dome itself gives but little aid in resisting this pressure, and if the deformation of the shape or a tear of the iron should be the consequence, the other results of the explosion might easily follow. The Committee deem this defect of form to be so manifestly sufficient to account for the explosion that they do not think it necessary to advert to any other, but strongly call the attention of boiler builders and engineers to the importance of avoiding such large openings in the shell in future.

Philadelphia, Nov. 13, 1851

THE WEST INDIA MAIL STEAM-SHIP, "PARANA."

The Royal Mail steam-ship *Parana*, Captain William Allen, arrived here at 5 p.m. to-day from Greenock, where she has been for the last five months, taking in her machinery. The *Parana* is another of the gigantic steamers built for the Transatlantic service of the West India Mail Company, of which the unfortunate *Amazon* was the pioneer. She is, in fact, of the same class as the *Amazon* and the *Orinoco*, and, both

as regards size and power, is nearly similar to those vessels. The *Parana* was built at Southampton, by Messrs. Wigram and Sons, of London, who have, within the last two years, established a flourishing shipbuilding yard as a branch of their Thames establishment. The construction of the machinery was entrusted to the eminent engineering firm, Messrs. Caird and Co., of Greenock; and, to enable the ponderous pieces of which her machinery is composed to be hoisted into their places, the Harbour Commissioners of the Victoria Pier at Greenock had to erect new cranes capable of lifting 70 tons at one time. Descriptions of the *Amazon* and the *Orinoco* are so fresh in the minds of the public that full details of the fittings of the *Parana* are almost unnecessary, inasmuch as the general plan and construction of this ship, with but trifling variations, arising from the difference of builders and engineers, are identical with those of the whole of the five ships built for this particular service. The *Parana*, it may however be said, is of 2,250 tons burden; the length of keel and forerake, 275 feet; depth of hold, including the spar-deck, 34 feet; beam, 41 feet; height between decks, 8 feet. She is fitted with two marine engines on the side-lever principle, of the collective nominal power of 800 horses (though capable of working to considerably above that power). The cylinders are of 96 inches diameter, with a 9 feet stroke. She has the improved patent feathering paddle-wheels, of 40 feet diameter, and in her construction every appliance and improvement that science and experience could suggest appear to have been adopted. Strength and substantiality are the distinguishing features of this fine vessel, while the fittings are plain and beautiful, and adapted for producing every comfort and convenience that can be desired in a packet steamer. The *Parana* has four decks, the spar deck being flush from stem to stern; and it is here that the immense magnitude of the vessel more especially strikes the eye. The main deck aft is fitted up with a double row of sleeping berths, entered from a promenade, arranged for great convenience during bad weather, coaling, &c. Forward, also, similar berths are provided, while both in the forward and afterward saloons there are on each side rows of sleeping cabins, each passenger having that great desideratum at sea, a cabin to himself. The saloon is capable of dining 200 persons, and there are, altogether, separate sleeping apartments for nearly that number of passengers. The store, baggage, specie, mail-rooms, and magazines, are on the orlop deck, the ladies' cabin being a commodious apartment at the stern part of the main deck, communicating by private staircases with the saloon below. The *Parana* has stowage room for 1,100 tons of coals, and 400 tons of cargo. She is full bark-rigged, has two funnels, and is as noble a looking steamship as any that ever carried the British flag. For either the peaceful and lucrative business for which she is intended, in forming a link in the chain of an important steam communication, or for the sterner necessities of warfare, in carrying the tremendous armament with which she might speedily be armed, the *Parana* is equally adapted, and the possession of a series of gigantic and powerful steamers, such as this, cannot but add immeasurably not only to the commercial greatness, but to the naval power of this country.

Now that so much interest is attached, and very properly attached, to the performances and speed of these monster steamships, that of the *Parana* on her recent voyage will not be uninteresting. Captain C. E. Mangles, the managing Director of the Company, and Mr. G. Mills, the Company's Engineer-in-Chief, were on board. A trial trip was made for the first time in the Clyde, on Tuesday last, which was of a most satisfactory nature, and the ship made a speed of 12¾ knots, equal to 15·83 statute miles an hour. The experiment of first turning round the engines under steam being thus perfectly successful, orders were given to coal the ship and start at once for Southampton; but a dense fog intervening, the departure was not effected till Thursday morning last, the 11th inst. At 7·40 A.M., when the *Parana* left Greenock, she ran with a slack tide from the Clock to the Cumbray Light, a distance of 13 3·5 knots, in 1 hour 10 minutes. Steaming on, and passing the Pladda Light, the ship was abreast of Copeland Island at 2·40 P.M. As the distance between Cumbray and Copeland Island is 64 miles, and as the time taken to run this distance was 5 hours 33 minutes, it follows that the average speed between these two points was about 12 knots per hour. The thick weather which is so prevalent in these parts, and the consequent danger of collision, having induced the prudent commander of the *Parana* —Captain Allan—to slow, and occasionally to stop the engines during the night, the speed of the ship was reduced (from 9·30 P.M. to 5·30 A.M.) to about 5 knots per hour. With daylight of the 12th, however, came the opportunity of setting on again full speed, as well as of again testing, later in the day, the speed of the ship. The distance from the Smalls to the Longship Lighthouse is about 101 miles (nautical), and this was run in 9 hours 5 minutes, giving an average speed of 11 knots. Up to

this time to nearly midnight of the 12th, the engines had been making 13½ and 14 revolutions; but when the Land's-end had been rounded, and the ship had come head to a strong east wind, the engines were brought up to about 12½. In spite, however, of this heavy easterly wind, which increased considerably during the latter part of the run, and of a good lump of a sea, the *Parana* continued to make good way, and ran from the Lizard to Portland, a distance of 114 miles, at 9½ knots per hour, in 12 hours. On the 13th, at 3·30 P.M., the *Parana* passed the Needles, and completed a run of about 567 miles in 56 hours, at an average speed of 10 knots per hour, including stoppages. Mr. Mills reports that the engines worked very satisfactorily; it was necessary to watch and cool the bearings during the run round, but the ship was not stopped once upon that account. Upon leaving Greenock, the *Parana* had 390 tons of coal on board, and she drew 17 feet 8 ins. aft, and 16 feet 11 ins. forward: the consumption of coals was very moderate, and, taking every circumstance into consideration, it is stated that a better result, in point of speed, has been obtained from this vessel than from either of the two previous ships, the *Orinoco* or *Amazon*.—*Southampton Correspondent of the Times.*

ELECTRIC TELEGRAPH EXPERIMENTS.

On Saturday, the 13th instant, Mr. Reid tried another series of interesting experiments on the South Western Railway, similar to those he performed at Dover on the 3rd instant, and as reported in our Journal of the 6th; one instrument and battery being placed in the Admiralty, Whitehall, and the other in the Portsmouth Dockyard,—distance, in round numbers, one hundred miles. Several messages were sent to and fro from the Admiralty to the Dockyard by the miniature battery with perfect success. This battery being removed, the piece of silver and zinc was then introduced into the mouth of the operator, and a message sent from London to Portsmouth, and repeated back correctly.

AMERICAN VIEW OF THE STEAM POWER OF ENGLAND.

There is a most lamentable general ignorance of the power of England, both among the people there and our people here. This we judge from the statistical facts respecting her steam navy and mercantile steam marine. Her steam navy is really terrific—being no less than 147 vessels, besides three new 80-gun propellers ready to be launched. One half of these only are in commission, but then she has 75 steam vessels, ready for war at any moment, the average tonnage of which is 800 tons each: some of them are very small and some very large, but the very smallest is fit to cross the Atlantic. The commercial steam marine of Britain numbers 1,184 steam ships and steam-boats. The city of London alone has 333 steam vessels, with a tonnage of 102,000 tons. The city of Glasgow has 88 steam ships, all fitted for sea, with a tonnage of 34,000 tons. In Liverpool there are 99 steam vessels, with an average tonnage of 21,059 tons. Thus, in three ports, there is a tonnage of steam vessels amounting to 157,059 tons. It is right that we should be well-informed about the power of foreign countries. It is our opinion that the policy of England always has been to hide her strength. It may be wise policy, and it may not—we have no occasion to discuss that point now, we only wish to present facts, for true information to our people. We have presented the tonnage of the steam vessels of three British cities, and we have rather under-rated it. If we allow an average tonnage of 200 tons to all the mercantile marine there, it will amount to 236,400 tons.

We have seen a statement in the *Cincinnati Gazette* about so many English steamboats being below 100 tons burden, and that we had no such class here. This is true; but every one of them are under-rated: and for all, the very smallest is fit for sea. One single Glasgow Company (the Cunard), has seven Atlantic steamships with a tonnage of 13,100 tons, and this force is to be increased about 6,000 tons. There are at least 100 steamships of 1,000 tons burden, each of which, upon an exigency, could be drafted into the British navy, and, in a few days, armed and equipped, not for defence but offensive operations. The statements that England may be invaded from France, is all sponge cake and Cologne water. Whenever her dockyards are active, all the European powers shake; they are vulnerable to her. She is able, in two weeks, to blockade all the ports of Europe, and defend her own at the same time.—*Scientific American.*

ON THE HYPOTHESIS RELATIVE TO LUMINOUS ETHER, AND AN EXPERIMENT WHICH SEEMS TO DEMONSTRATE THAT THE MOTION OF BODIES CHANGES THE VELOCITY WITH WHICH LIGHT IS PROPAGATED WITHIN THEM. BY M. H. FIZEAU.

Numerous theories have been proposed to account for the phenomenon of aberration

on the system of undulations. Fresnel, in the first place, and more recently Messrs. Doppler, Stokes, Challis, and several others, have published important articles on this subject; but it appears that none of these theories have received the entire assent of natural philosophers. Indeed, in the absence of certain knowledge of the properties of luminous ether, and of its relations to ponderable matter, it has been found necessary to make hypotheses, and amongst those which have been proposed there are several more or less probable, but none which may be considered as proved.

These hypotheses may be reduced to three principal ones. They have reference to the condition in which the ether existing in the interior of a transparent body is to be conceived.

Either the ether is adherent, and as it were attached to the molecules of a body, and consequently partakes of the motion which may be given to that body:

Or, the ether is free, independent, and is not carried along by the body in its movements:

Or, finally, by a third hypothesis, which partakes of the other two, a portion only of the ether is free, the other portion is fixed to the molecules of the body, and that alone moves within it.

This last hypothesis, which we owe to Fresnel, was started with the view of accounting at the same time for the phenomenon of aberrations, and a celebrated experiment of Mr. Arago, by which it is shown that the motion of the earth is without influence upon the refraction which the light of the stars undergoes in a prism.

We can examine the value which, for each of these hypotheses, is to be given to the velocity of light in bodies, when we suppose those bodies in motion. The value of these velocities may be changed by the fact of the motion.

If we suppose that all the ether is carried along with the body, the velocity of the light will be augmented by the entire velocity of the body, supposing the ray to be projected in the direction of the motion. If the ether is supposed to be free, the velocity of the light will not be changed.

Finally; if only a portion of the ether is carried along, the velocity of the light will be augmented, but by a fraction only of the velocity of the body, and not by the totality, as in the first hypothesis. This consequence is not as evident as the preceding ones, but Fresnel has shown that it may be supported by very probable mechanical considerations.

Although the velocity of light is so enormous in comparison with the velocities which we are able to give to bodies, yet we possess, at the present day, means of observation so delicate, that it has been thought possible to determine by a direct experiment, what is really the influence of the motion of bodies on the velocity of light.

We owe to Mr. Arago a method founded on the phenomenon of interferences, which is capable of indicating the smallest variation in the indices of the refraction of bodies. The observations of Messrs. Arago and Fresnel, upon the difference of refraction which exists between dry and moist air, have shown the extraordinary sensibility of this means of observation.

It is by adopting the same principle, and joining the double tube of Mr. Arago to the apparatus of two conjugate telescopes which I had employed for the determination of the absolute velocity of light, that I have been enabled to study directly in two mediums—air and water—the effects of the motion of a body on the light which traverses it.

I shall endeavour to point out, without the aid of a drawing, what was the course of the light in this experiment. From the focus of a cylindrical lens, the solar rays entered almost immediately the first telescope by a lateral opening near its focus—a transparent mirror, whose surface was at an angle of 45° to the axis of the telescope, threw them by reflection in the direction of the object glass.

After passing out from the object glass, the rays, having become parallel to each other, arrived at a double slit, each opening of which corresponded with the entrance of one of the tubes. Thus a very narrow pencil of rays penetrated into each tube, and traversed its whole length (1·487 m. = 4 ft. 10 in.)

The two pencils of light, still parallel to each other, reached the object glass of the second telescope, were refracted, and by the effect of that refraction united at its focus; there they encountered the surface of a mirror perpendicular to the axis of the the telescope, and underwent a reflection, which returned them towards the object glass. But, by the effect of the reflection, the pencils had changed their route, so that that which was before to the right, passed to the left after the reflection, and *vice versâ*. After having again traversed the object glass, and thus become once more parallel to each other, they entered a second time the tubes; but as they were inverted, that which had passed through one of the tubes in going, passed through the other tube on its return.

After their second passage through the tubes, the two beams again traversed the double slit, re-entered the first telescope,

and, passing through the transparent glass, interfered at its focus. There they formed, by their mutual action, fringes of interference, which were observed with an eye-piece provided with a scale of divisions at its focus.

It was necessary that the fringes should be very wide for the purpose of permitting the appreciation of small fractions of the width of a fringe. I found that this result was obtained, whilst still preserving a great intensity of light, by placing before one of the slits a thick glass, inclined in such a manner as to show the two slits by the effect of refraction, as though they were nearer to each other than they were in reality; one may thus give to the fringes variable dimensions, and choose that which is most suitable for the observations. The double passage of the light has for its object the increase of the distance passed over within the medium in motion, and, moreover, to compensate entirely for the influence of an accidental difference of temperature, or of pressure in the two tubes, whence might result a displacement of the fringes that would be confounded with the displacement which the motion might produce, and would render the observation uncertain.

Indeed, it is very easy to see that, by this arrangement, each point situated on the path of one of the pencils is equally on the path of the other, so that a change in the density at any point whatever in the passage acts in the same manner on the two rays, and cannot, consequently, have any influence upon the position of the fringes. The fact that the compensation is total, was verified by placing a thick glass before one only of the two slits, or, indeed, by filling with water one only of the tubes, the other being filled with air. Neither of these experiments caused the slightest change in the position of the fringes. Relative to the motion, we see, on the contrary, that the two beams are submitted to opposite influences.

If we suppose, in fact, that in the tube placed on the right the water flows towards the observer, the beam coming from the right will have passed through the tube in the direction of the motion, whereas the beam coming from the left will have passed through in a direction contrary to the motion.

By making the water in the two tubes flow at the same time in directions opposed to each other, we perceive that the effects should be added. This double current being produced, we may reverse the direction at the same time in each tube, and the effect should again be doubled.

(*To be continued.*)

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MARCH 18, 1852.

John Wallace Duncan, of Grove End-road, St. John's-wood, gentleman. *For improvements in engines for applying the power of steam or other fluids for impelling purposes, and in the manufacture of appliances for transmitting motion.* Patent dated September 4, 1851.

Claims.—1. Several constructions of rotary engines.

2. The construction of condensers or other apparatus for condensing steam in steam engines, having rotary discs or plates continuously cooled by immersion, and exposed to the steam to induce condensation.

3. The construction of condensers or other apparatus for condensing steam in steam engines, having a combined series of tubes, or other channels through which the cooling medium circulates, such tubes or channels having a rotary motion, in order to present a change of cooling surface to the steam as it enters from the exhaust passage of the engine.

4. The application of endless belts of gutta percha having diagonal blades, constructed and arranged for the purpose of transmitting motion to ships and other vessels.

5. The manufacture of wheels and bosses used in machinery for preparing and spinning fibrous substances of gutta percha and other specified materials masticated and combined together, as described.

John Rowland Crook, of Birmingham, hatter. *For improvements in hats, caps, and bonnets.* Patent dated September 11, 1851.

This invention has particular reference to the class of hats known by the appellation of "silk hats," and has for its object to make them lighter, softer, more elastic, and better ventilated than heretofore, and consequently easier of wear, and more durable.

With this view, instead of making the crown, the body, and the brim of the hat, as is now commonly done of three separate pieces, each of two or three thicknesses of calico (or some other flexible material), and cementing the whole together by a solution of shellac (a process technically called "priming"), the patentee makes all these parts, or in other words, the entire foundation of the hat, of one single entire piece, without any seam or joining, and that piece of one thickness, except at the edges and other places, where strengthening pieces are introduced, as hereafter explained. Or he

makes the body only of one piece of one thickness as aforesaid, and the crown, or brim, of a separate piece or pieces. The material which he uses for the body and brim is palm leaf, or as it is sometimes called "Brazilian Grass" plait, but for the brim he prefers willow on account of its greater stiffness and porousness. The palm leaf, or Brazilian grass, is first roughly plaited into the form of the intended hat, cap, or bonnet, then soaked in boiling water and firmly moulded on a block into the form desired to be permanently given to it. To facilitate the moulding of the piece of plait into the proper form, a small piece is cut out from the centre, or part corresponding with the centre of the crown, when the hat is made up, and filled up with a piece of scale board, mill board, calico, or other suitable stiff slight material. To strengthen the hat in those places most exposed to wear, such as the edges of the brim and crown, and thus enable it the better to retain any given shape, the patentee cements to the foundation at these parts pieces of tape, or strips of net, or some other suitable binding material. When the foundation of the hat has been thus blocked out and strengthened at the points most exposed to damage, the whole is varnished over, and then covered with silk or cotton plush in the manner very commonly followed. The palm leaf, or Brazilian grass, is rendered repellent of water, by steeping the grass or other substitute before or after plaiting in some waterproof composition, such as soap and alum, or copal varnish; as to the use of which waterproof compositions, however, no claim is made.

Claim.—In regard to the manufacturing of silk hats, caps and bonnets, the making of the foundation of the hat of one entire piece of palm leaf, or "Brazilian Grass," rendered water repellent by the plans aforesaid, and without seam or joining, or need of "priming," and of one single thickness throughout, except at the edges, and other places where strengthening pieces are requisite, as before specified, or making the body only of one piece of one thickness, as aforesaid, and the crown or brim of a separate piece or pieces.

David Main, of Beaumont-square, engineer. *For improvements in steam engines and in furnaces.* Patent dated September 11, 1851.

Claims.—1. A duplex compensating engine is described, in the peculiar combination and disposition of parts of which the same consists; that is to say, in so far as regards certain arrangements, whereby the power of the engine is transmitted to the crank-shaft, and that shaft is caused to make two revolutions for each stroke of the pistons, and whereby also all strain on the crank-shaft bearings is prevented, or nearly so.

2. A modification of the preceding engine.

3. A direct-acting engine described, in so far as regards certain arrangements whereby it is adapted to the working of two screws or wing propellers under the quarters of a vessel, and a mode of working the air-pump by means of the combined motion of the crank-shaft and the stroke of the piston.

4. Certain modes of fitting the shafts for screws or other wing propellers.

5. A method of working the air and other auxiliary pumps of steam engines, at one-half the speed of the engines themselves, by means of helical wheels, as represented and described.

6. Two several improvements in furnaces.

Alexander Parkes, of Birmingham, chemist. *For certain improvements in the manufacture of copper, and in the separation of some other metals therefrom, and in the production of alloys of certain metals.* Patent dated September 11, 1851.

The "improvements in the manufacture of copper" consist in the addition of metallic iron and zinc at different stages of the process of smelting, whereby copper of superior quality may be obtained from comparatively inferior ores.

When iron is used, the patentee has found it advantageous to add the same to the copper while in the state of "white metal;" but it may also be beneficially employed at subsequent stages of manufacture, especially when sulphur is present in the ores under treatment. The following modes of operating have been found to answer well in practice. The ores are treated in the manner usually adopted by smelters until the product has reached the roaster furnace, and has been allowed to cool therein, to become converted to the state of "close regule;" the iron (either wrought or cast) is then added in the proportion of 1 cwt. to every charge of 2½ tons of regule, and the doors of the furnace closed. The heat is then kept up until the metal is brought to the state of "pimple copper," when it is tapped off, and either treated at once in the usual way in the refining furnace, or has metallic zinc added to it in the manner afterwards described. Another method of operating is as follows:—After the iron has been added in the roaster furnace, the metal is run off in the state of "light regule," and the pigs are stripped in the manner practised by smelters when making best selected copper; the portions of metal so stripped are again

introduced into the roaster furnace, using one-half cwt. of iron to every charge of 2½ tons of metal, and the metal is heated until it attains the state of "pimple copper," when it is tapped off and transferred to the refining furnace, where the process is finished in the ordinary manner, or by the addition of zinc, as afterwards described. This process is adopted only when very pure copper is required to be obtained. Or, instead of introducing the iron in the roaster furnace, it may be added to the copper, while in a fused state, in the refining furnace. In this case, the patentee uses 1 cwt. of iron for every charge of 4 or 5 tons of copper, and the metal is well agitated for the purpose of oxidising the iron, and when the metal has arrived at "set pitch," it is poled and laded out in the usual manner; or metallic zinc is added before poling, and the process is then conducted as nextly described. The iron is not to be used in the refining furnace with copper which has been previously treated with iron in the roaster furnace.

The process of using zinc is as follows:—The zinc, in a metallic state, is added to the fused copper in the refining furnace, when the metal is at "set pitch," in the proportion of 1 cwt. of zinc to every charge of about 5 tons of copper, and after remaining for about two hours to allow the zinc to volatilize, the metal is poled and ladled out in the usual manner. Although the above-mentioned proportions of iron and zinc have been found to answer well in practice, the patentee does not confine himself thereto, as it may be necessary occasionally to vary the same; they will be found, however, well adapted for the qualities of copper ores generally operated on.

The "improvements in the separation of other metals from copper" have relation to the treatment of argentiferous copper ores, and are based on the discovery that silver may be volatilized by applying heat to the same when in combination with metallic zinc and arsenic, and are exemplified in the three following processes. The apparatus employed in carrying them into effect consists of a reverberatory furnace having suitable flues and chambers in connection therewith, wherein the volatilized silver and other metals may be condensed. The silver is obtained in a metallic state by collecting the condensed products, and treating the same by cupellation, or any other ordinary process.

First Process.—When the argentiferous compound is in a metallic state, and contains about 10 oz. of silver to the ton, the patentee adds to every ton thereof previously melted, from three to five per cent. of metallic zinc, from one quarter to one half per cent. of white arsenic, and about half a cwt. of anthracite coal or other suitable carbonaceous matter. He then closes the furnace door, and keeps up the heat for about six hours, at the expiration of which time the silver will be found to have passed over with the other volatile metals, and to have be condensed in the flues and chambers in connection with the furnace.

Second Process.—When the argentiferous compound is principally in the state of sulphuret, and contains about 10 oz. of silver to the ton, the patentee adds to every ton thereof, in a melted state, from six to ten per cent. of calamine or other oxidized compound of zinc, with lime or other suitable flux if needed, and about half a cwt of anthracite coal: and if the compound is free from arsenic, from one quarter to one half per cent. of white arsenic. He then closes the furnace, and proceeds as above mentioned. In this process it is preferred to add the zinc and arsenic on the melted metal when in a state of "pimple copper."

Third Process.—When the argentiferous compound consists chiefly of oxide or carbonate of copper containing, as before, about 10 oz. of silver to the ton, the patentee adds to it, while in a melted state, and after skimming to remove impurities and earthy matters, from 10 to 15 per cent. of blende, or other sulphurous compound of zinc, from one quarter to one half per cent. of white arsenic, and 1 cwt. of anthracite coal. He then proceeds, as above directed, and obtains the volatilized silver from the flues and chambers of the apparatus.

When the ore operated on contains a greater proportion of silver than 10 oz. to the ton, the quantity of zinc and arsenic must be increased in a like ratio; and when the silver exceeds 50 oz. to the ton, it is recommended to add the zinc and arsenic by degrees instead of altogether. Although white arsenic is directed to be used, equivalent proportions of other compounds thereof, or even metallic arsenic, may be employed.

The "improvements in the production of alloys" consist in combining alloy of chromium and nickel with other metals in proportions varying according to the nature of the use to which the compound metal is to be applied. The chromium and nickel alloy is composed of equal parts of oxide of chromium and oxide of nickel, or of two parts of oxide of chromium to one part of metallic nickel, melted together in a close crucible, being kept covered the while with charcoal or carbonaceous material. The following proportions are recommended for the production of "white metal" alloys.

First Compound.—Ten parts of chromium and nickel alloy, and ninety parts of tin.

Second Compound.—Twenty parts of chromium and nickel alloy, and eighty parts of iron.

Third Compound.—Twenty parts of chromium and nickel alloy, sixty parts of iron, and twenty parts of zinc.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Joseph Denton, of Rochdale, Lancaster, gentleman, for improvements in machinery or apparatus for manufacturing looped, terry, or other similar fabrics. March 12; six months. (N.B. This patent being opposed at the Great Seal, was not sealed till he 12th March, but bears date the 23rd February last, the day it would have been sealed had no opposition been entered.)

John Mercer, of Oakenshaw, Clayton-le-Moors, chemist, and John Greenwood, of Irwell Springs, Bacup, Turkey-red dyer, both in Lancaster, for certain improvements in preparing cotton and other fabrics for dyeing and printing. March 15; six months.

Francis Wheatley, of Greenwich, Kent, gentleman, for an improved safety cab-omnibus. March 18; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Mar. 11	3170	J. Cooper & J. C. Forsell	Leicester	The crystal reel.
,,	3171	D. Simpson	Lancaster	Regulating pressure-tap.
12	3172	H. Stephens	Stamford-street, Blackfriars	Adjustable pencil-point.
,,	3173	Mr. Bailey	Bayswater	Safety letter-box.
,,	3174	H. Doulton and Co.	Lambeth Pottery	Invert block for the bottoms of sewers or culverts in stoneware.
,,	3175	C. and J. Seagrief	Green-street, Park-lane	Portable wardrobe.
13	3176	A. Marion and Co.	Regent-street	Pencil cutter (179 Provisional).
,,	3177	C. Gray and Sons	Sheffield	Reaping machine-knife.
15	3178	Well and Greenway	Birmingham	Fastening for doors, windows, &c.
16	3179	W. Fife	Birmingham	Metallic pen.
,,	3180	J. Morris and Sons	Astwood Bank, near Redditch	Needle-case.
,,	3181	C. Rowley	Birmingham	Fastening for elastic bands.
,,	3182	W. Stahl and E. Prinet	Yardley-street, Wilmington-sq.	New dividers and callipers (110 Provisional).
,,	3183	J. C. Boyd	Lower Thames-street	Double action or self-adjusting scythe.

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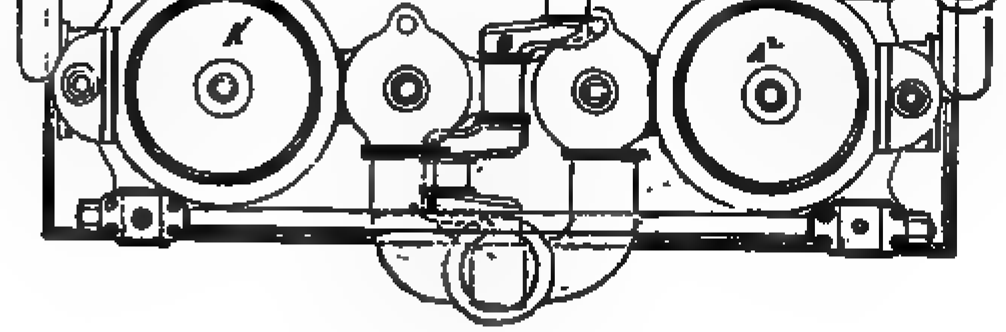
SCREW STEAM NAVIGATION.—MAIN'S PATENT.

Fig. 1.



SCREW STEAM NAVIGATION.—MAIN'S PATENT.

REMARKABLE as has been the extension which steam navigation has experienced of late years, owing to the substitution of the screw for the paddle-wheel, and clearly enough understood as are the conditions on which success in the use of the screw depends, it must be confessed that a perfectly unexceptionable screw steam engine is still among the engineering desiderata of the day. All experience shows that a high velocity of the screw shaft is indispensable; and to obtain such high velocity economically constitutes the great practical difficulty of the case. If the engine is connected directly to the screw shaft, then both engine and shaft, work at the same velocity, and what may be a most desirable rate of going, as regards the one becomes most prejudicial, as regards the other—causing an excessive degree of friction, and tear and wear in all the moving parts; and this is more especially the case where the engine is a condensing one, and the air and other pumps are actuated by the same movements as the steam pistons.

If, again, the engine be connected to the screw-shaft by multiplying wheel-gearing, a high velocity of the shaft is only obtained at a great sacrifice of steam power, consequent on the indirectness of the mode of its application, accompanied by the additional objections of wasteful occupation of space, increased noise and vibration, &c. A strong sense of the defects of both these descriptions of screw steam engines has led to the new arrangement which we have now to lay before our readers, which, if it prove only as efficient in practice as it is novel and ingenious in design, must obtain for its author a foremost place among steam-engine improvers. Here we have the screw-shaft made to work at double the speed of the engine and pumps, yet *without the intervention of any intermediate gearing whatever.* The following explanatory details we take from Mr. Main's specification:—

Specification.

My invention consists of an improved steam engine, to which I give the name of the "Duplex Compensating Engine," because it consists of a pair of engines so disposed and combined that every single stroke of each piston produces, with the help of a single stroke of its companion piston, two revolutions of a working shaft (say, for example, a screw shaft), and because any strain which either engine might exert on the crank-shaft is so counteracted or neutralised, that the dead weight of the moving parts is all that the shaft bearings have to sustain. Fig. 1 exhibits a front elevation of this engine, as applied on board a ship; and fig. 2 a ground plan. A^1 and A^2 are the two cylinders or engines with their respective air-pumps and other appendages; and B^1B^2 the bed-plates or foundations to which they are fixed, which are secured to the beams and kelson of the ship. Sufficient space is left between the two engines for the slide-valve gear and pumps. D is the driving-shaft which has its bearings in bed-plates, and is not placed lengthways of the ship, but across the two engines, having four cranks, two of which, for one engine, are placed at right angles to two cranks from the other engine. E is a second or supplementary shaft, from which the slide valves, and bilge, and feed-pumps are worked; this shaft is supported on bearings overhead, and lies in the same direction as the other, only with a lead of about one-eighth or three-eighths of a revolution in advance. The cap of each piston-rod is connected by two rods *a a*, with the short arm of a lever L, the long arm of which is connected by a vertical rod V, with the lower crank shaft D. When the engines are set to work, the two piston-rods ascend together, and the centres of their caps describe a line equal to the stroke of the piston, which line may be considered as the base of a triangle, the other two sides of which would be represented by the connecting-rods *a a*, when at the end of the top and bottom strokes, so that when the piston has ascended to the half stroke, the lever L will have passed out a distance equal to the difference between the vertical height of the supposed triangle and the length of the rods *a a*, and so also that, when the piston has completed its top stroke, the lever L will have resumed its original position; consequently, when the piston has made one ascent, the lever L will have both gone out and come in—or, in other words, while the piston has made one single stroke, the lever

will have made one double stroke, and produced by its connection with the crank-shaft beneath D two revolutions of that shaft. It is true, that the short end of the lever L passes through a space but equal to one-half of the stroke of the piston-rod; yet it must be observed, on the other hand, that simultaneous with this action of the lever, there is a similar action taking place with the lever of the other or opposite engine; therefore the spaces passed over by the short ends of the two levers are, jointly, equal to the traverse of the piston. As before stated, the cranks on the upper shaft E should be set from one-eighth to three-eighths of a revolution in advance of the others; but I may observe, that the latter position is the preferable one, as then the two engines will nearly balance one another. It is further deserving of remark that, from the manner in which the levers L L act—that is to say, from the one lever always rising while the other is falling—this must necessarily have the effect of equalizing the strain on the crank-shaft, and abstracting as little as may be from the working efficiency of the engine. The slide-valves are worked by an equilateral motion, by which means the weight of the valves are just overbalanced by the weight of the eccentric rods, &c.; and so, throughout, great care has been taken that every strain or thrust shall be effectually counterbalanced or counteracted, and that the two engines shall work in perfect unison.

The advantages of this system of construction are briefly these:—First, that the working shaft, to which it is desirable to give the utmost speed possible, revolves twice as fast as the moving parts of the engine themselves, and with a proportionate diminution of tear and wear. Second, that the whole power of the steam is transmitted to the working shaft without throwing any strain on the shaft bearings. Third, that the entire weight of the machinery is thrown low in the vessel—so much so, that in ships of war the whole may be under the water-line. Fourth, that the working parts of these engines work vertically, and thus better ensure their uniform wear; and, lastly, that all the parts are easily accessible for purposes of repair or replacement.

Mr. Main's patent includes some other valuable improvements, of which we shall give a detailed account in a future Number.

THE STEARIC CANDLE MANUFACTURE.*

Among those processes of manufacture which, during the last thirty years, have rapidly advanced to a high state of perfection, not the least conspicuous is that whose aim it is to furnish the community with an efficient, and at the same time an economical artificial light. And the results exhibited in the production of the best sorts of candles in 1852 are as far in advance of what were obtained in 1822 as those of this latter period surpassed the tallow dips of the 16th century.

Of the causes which have chiefly contributed to this striking improvement in the candle manufacture, the most remarkable are—the discoveries of M. Chevreul respecting the constituents of fatty bodies, and the relief of the candle manufacture in England from the operation of the Excise Laws.

Mr. G. F. Wilson, the able and enterprising Manager of Price's Patent Candle Company, lately, at the request of the Society of Arts, delivered a Lecture upon this important manufacture; and we conceive that we cannot do better than avail ourselves of the particulars stated by him, and place the more prominent of them before our readers:

The stearic candle manufacture has of late years become an extensive one; in our works alone we employ above 900 hands, and have this winter made 100 tons—7,000*l.* worth—of candles weekly.

The science of candle-making had its origin in France; and to take its history from the very commencement, I have only to go back to 1811, the date of the earliest labours of Chevreul, the father of our branch of chemistry.

* "The Stearic Candle Manufacture. By G. F. Wilson, Esq., Managing Director of Price's Patent Candle Company. To which are appended Papers on the Slave-trade and the Soap-tax." London: Lewis and Son, Finch-lane.

Before this time, our industry was not only innocent of science, but scarcely even deserved the name of an art, as it consisted of little more than taking greasy materials in their natural state, and applying to them a means of combustion, which has been done even in savage nations from time immemorial.

Chevreul's labours began in 1811. His first great discovery, announced to the Academy of Science in a paper dated 5th July, 1813, was, that fatty bodies are of a compound nature; it showed that fat was not, as previously supposed, a simple organic substance, like starch or alcohol, but a real salt formed of animal acid, combined with an animal base, and that this combination could be broken, and the acid obtained in a separate state. This discovery is the basis of the whole of our art; for it is the fatty acid which is the inflammable constituent of fats, and until it is set free from its comparatively uninflammable base, its valuable burning properties are masked in an extraordinary degree. It is the acid which is the valuable part; and all our efforts in candle-making have been, and still are, directed to obtain this in the purest, hardest, or cheapest form possible. The acid of which Chevreul announced the discovery has since received the name of margaric, from "margarita," a pearl, its crystals having a pearly appearance.

On the 2nd November of the same year, 1813, Chevreul read a second paper to the Academy on the discovery of another very different fat acid, a liquid one, which has since received the name of oleic, from "oleum" oil. A third valuable paper followed in the next year, 1814; a fourth in 1815, a fifth and sixth in 1816, and a seventh on the 26th February, 1818.

He still continued his labours, till the chemists of the Institute, especially Berthollet and Gay Lussac, persuaded him to consolidate all his published discoveries, and those made since his last publication, into one compact work. He devoted two years to this object. The work appeared in 1823, under the title of "Chemical Researches on Fatty Bodies of Animal Origin."

As yet, we had nothing but pure science: scarcely any attempt seems to have been made at its industrial application. Chevreul himself was at last persuaded into making one; this was in the year 1825, in conjunction with Gay Lussac, and under the protection of French and English patents. But when he thus broke his good resolution, and left his own domain of science for that of art, his wonted success appears to have failed him. Commercial success was reserved to a manufacturer, M. de Milly, who perfected the manufacturing details of the processes, and made improvements in preparing wicks. M. de Milly informs me that he commenced manufacturing in 1832; his candles were called Bougies de l'Etoile, from the barrier of that name in Paris, near which his factory was situated.

The process worked by M. de Milly for obtaining the acids free from their base, glycerine, was that suggested by Chevreul, not greatly modified, and may be thus described.

Tallow is boiled up with thin cream of lime, which causes the fat acids by superior affinity to forsake their glycerine to combine with the lime, the glycerine dissolving in the water; this combination is then broken by means of sulphuric acid, which, seizing on the lime, sets free the fat acids; these are then separated, the liquid from the solid, by means of pressure.

This process of making fat acids is called "lime saponification," and is still used.

The first grand point, the practical carrying out of the scientific discovery, had now been accomplished; but when I mention that stearic acid required nearly twice and a half its weight of tallow to produce it, and that the other product of the tallow was a comparatively refuse oil, it will be readily understood that the second most important point, that of cheapness, was as yet unattained; and when at length found, it was, most of those present will be surprised to hear, through the instrumentality, however unconscious, of our illustrious President. From 1832 to 1840, not much progress was made; other manufacturers in France and England followed De Milly, and established factories for the new candles. This led to some improvements in the manufacture, and to a little lowering of the price (which, however, remained about double that of ordinary tallow candles), and in 1836, Dr. Hempel, a Prussian engineer, and Mr. Blundell, took out a patent for making fat acids from palm oil; the candles manufactured under this by Messrs. Blundell and Spence gave a good light, but, being dark in colour, never came into general use.

I have shown that the first scientific discovery, as well as the first practical application, were exclusively French. It was now the turn of the English to step in. This they did; first in a practical application of the then science, and afterwards in a rapid series of developments of the science itself.

To explain how cheapness was arrived at, I must go back several years, and may begin by saying that in 1831 our trade was freed from the excise; those only know its cramp-

ing influence who have worked under it. Our neighbour trade, soap-making, shows its effect in the fact that the German soap-makers are so far in advance of ours, that they buy from us hundreds of tons of oleic acid, on which they pay freight, commissions, and other charges, while English soap-makers cannot use it, though at their own doors. In France, a soap work for the oleic acid forms part of almost every stearic candle factory; here, the nuisance of being subject to fixed times and rules of work, and to prying excisemen, in most cases prevents this.

In the year 1829, Mr. James Soames took out a patent for separating cocoa-nut oil into its solid and liquid parts. In 1830, this was sold to Mr. William Wilson and Mr. Lancaster, who trading under the name of E. Price and Co., brought it into operation the same year. Afterwards, owing to the very irregular supply of the crude material, Edward Price and Co. were compelled to establish extensive crushing-mills in Ceylon for separating the oil from the kernel of the cocoa-nut; these are still at work. The kernel is first dried, then crushed under edge stones, and lastly subjected to cold and hot pressure. Extensive plantations of cocoa-nut trees have been made in Ceylon, many of which are now coming into bearing. We have above 1,000 acres in this state.

E. Price and Co. perfected the manufacturing details of Mr. Soames' process, and introduced several improvements, among others, substituting, in 1835, for the sail-cloth first employed for surrounding the material to be pressed, mats made from the fibre of the cocoa-nut husk, many experiments having shown that nothing so completely answered for press cloths for cocoa-nut oil as its own husk. The matting was woven by them for their own use, and supplied to other manufactures for press cloths. It was afterwards suggested, I believe, by Colonel Logan, as a floor-cloth; for which purpose it is now used very extensively.

The solid result of pressure, the cocoa-nut stearine, was an improvement upon tallow, but owing to the candles made from it requiring snuffing, they never came into very extensive use; the invention was, therefore, comparatively valueless, until at the time of the Queen's marriage in 1840, one of the proprietors, Mr. J. P. Wilson, while experimenting to make cheap self-snuffing candles for the window illuminations, discovered that a combination of the cocoa-nut stearine with the newly-introduced stearic acid, would make candles giving a beautiful light without requiring snuffing, that could be sold in the shops for a shilling a pound; these, under the then new name of composite, soon became very popular. The trade in these mixed candles is now immense.

In March, 1840, Mr. George Gwynne took out a patent for distilling fatty bodies in a vacuum apparatus, and also for distilling fatty acids exposed to atmospheric pressure. This valuable specification drew particular attention to distillation for its proper object,—namely, the purification of fat acids; and showed the point to be aimed at to be the exclusion of the air from the apparatus. I think the method described would be difficult to carry out on the large scale. Mr. Gwynne is a director of our company.

In 1842, Edward Price and Co. took out a patent in the name of Mr. W. C. Jones (a working chemist in their employment), for distilling cocoa-nut oil and its acids, and converting them into a neutral substance by distilling them after combination with lime.

Candles, beautiful in appearance, were made under the second head of this invention—namely, the distilling cocoa-nut acids; but on putting them out a choking vapour was given off which produced violent coughing. We consulted my old master, Professor Daniell, upon this, who gave it as his opinion that the vapour was that of the fat acid itself, and recommended us to try dowters, the old-fashioned flat snuffers, hoping to extinguish the candles instantaneously. This lessened the evil, but did not entirely remove it; the candles, therefore, were never brought into the market. Under the last part of this patent, distilling cocoa-nut lime-soap, we made beautiful candles, resembling those from Paraffine, burning perfectly, but the loss of the material in the process was so great that subsequent improvements superseded its use. Under one part of this patent, the distillation was carried on sometimes with the air partially excluded from the apparatus by means of the vapour of water, sometimes without; the low evaporating point of the cocoa-nut acids rendering the exclusion of the air a matter of much less importance than when distilling other fat acids.

It was during experiments connected with this patent that Mr. Jones and I first tried using vapour of water to exclude the air from the apparatus during distillation. In distilling the cocoa-nut acids, combined with lime, in a small gun-metal retort, we found that the product of distillation was light-coloured only so long as the water mixed in the lime soap distilled along with it; we then fixed a cup on the top of the retort out of which water slowly dropped. This produced the anticipated effect of increasing the yield of light-coloured material.

In 1842, E. Price and Co. took out a patent in the names of Mr. Jones and my-

self, the principal claims of which are the distillation of fats previously acted on by sulphuric acid, or by nitrous gases. This patent contains a new chemical process. M. Frémy, in his valuable paper in the "Annales de Chimie," describes treating oils with half their weight of concentrated sulphuric acid, by which their melting point was greatly raised. He gave, however, particular directions that the matter under process should be kept cool, his words are, "ayant le soin d'entourer le vase dans lequel on opère d'un mélange réfrigérant;" instead of doing this we found it advantageous to expose the mixture of acid and fat to a high temperature, and still do so. While Mr. Jones and I were experimenting under this patent in one part of our works, Mr. Gwynne was at work in another with a small silver retort connected to an air pump. His object was our carrying out on the large scale his patent of 1840 (under which we had taken a licence), but finding that steam excluded the air as effectually, and with much fewer manufacturing difficulties than the air pump, we combined our forces upon this, and in 1843 took out two patents for improvements in the processes and apparatus, under which we still work.

Our present process is this:

Six tons of our present raw material, palm oil, are exposed to the combined action of $6\frac{2}{7}$ cwts. of concentrated sulphuric acid, and a temperature of 350°Fahr.; in this process the glycerine is decomposed, large volumes of sulphurous acid gas given off, and the fat changed into a mixture of fat acids of a very dark colour, with a high melting point: this is washed to free it from charred matter, and adhering sulphuric acid, and is then transferred into a still, from which the air is excluded by means of steam. The steam used by us is heated in a system of pipes, similar to those used for the hot blast apparatus in the manufacture of iron, the object of heating the steam being to save the stills, and reduce as much as possible gaseous loss in distillation.

It was long supposed that arsenic was requisite in making perfect stearic candles. Wax was afterwards known as a substitute, but its expense was a great drawback to its use. At this time, the candle material was poured at a high temperature, about 240°, into cold moulds, and being long in congealing, crystallization would have taken place, and disfigured the surface of the candles. Arsenic and wax disturbed the formation of the crystals, and produced a uniform surface. Soon after the use of arsenic was proved to be dangerous, it was discovered that if the stearic acid was poured at its congealing point into moulds, at about the same temperature, perfect crystals could not form, and that beautiful candles were produced. The object for the use of arsenic was thus done away with.

There is no doubt of the employment of arsenic being unsafe, but a great deal of nonsense was talked about it, and the public took refuge in spermaceti candles, many of which, I am credibly informed, at that time contained more arsenic, to break their larger crystals. It is not now, I believe, ever used either in spermaceti or stearic candles.

Mr. Wilson then describes the processes of preparing the wicks and of moulding:—The cotton after plaiting is dipped in a solution of a salt, frequently borax; it is often supposed that this preparing has for its object to render the wicks more combustible, but the reverse is the fact. The plaiting gives the required curve to the wick, the solution preserves it from being much acted upon by the flame, except at its extreme point, at the edge of the flame, in contact with the air, where it is consumed. The means principally employed by us for moulding are these:—The frame on the table you will see has a box attached to it, containing a bobbin for each mould, the same movement that expels the one set of candles from the mould uncoils a sufficient length of wick for the next; this is separated from the finished candles by means of a knife travelling on a rack; a set of forceps then holds each wick over the centre of its mould, which is now passed along a railway through a closet heated by steam pipes, by which it is raised to the required temperature by the time it arrives at the filler; having received its charge, it passes on till the material is sufficiently cooled, to allow of the forceps being withdrawn without disturbing the position of the wicks—a little further on the superfluous material is scraped off—the mould is then passed across by means of a travelling truck to a parallel line of railway; by the time it has traversed the length of this, and arrived at the drawer, the candles are sufficiently cold to be removed. Each machine has on an average 200 moulds, each mould contains 18 bobbins, and each bobbin, when first cottoned, 60 yards of wick, so that supposing all the frames of our seven machines to be fresh cottoned at the same time, we should have above 800 miles of wick in work.

[Mr. Wilson has appended to his Lecture an interesting paper by Dr. Kehoe, suggesting the establishment of a trading settlement at the confluence of the Niger and the Tchadda, for the purpose of calling more fully into operation the industrial resources

of Central Africa, as the best means of checking the Slave-trade; and he has also reprinted the able protest of "A Committee of Soap-makers," which exhibits in a striking point of view the injurious effects of the Excise-duty, both on the manufacturers and on the great body of the working classes.]

LONDON FIRES IN 1851.—BY MR. W. BADDELEY, C.E., INVENTOR OF THE PORTABLE CANVAS CISTERNS; IMPROVED JET-SPREADERS; FARMER'S FIRE-ENGINE; EVERY MAN HIS OWN FIREMAN, ETC., ETC.

"The statistics of London fires are by no means devoid of interest, and the time may come when they will form an index to the social advancement of the people; for in proportion as houses are built more and more fire-proof, and habits of carefulness become more and more diffused, the number of destructive fires will assuredly lessen."—*Knight's London.*

The first year of the present half century was emphatically a *great* year; in it there were a great many fires, some of them attended with great loss, while others were attended with fatal results productive of great regret. The known fires in the Metropolis numbered 928—the unknown (save to the parties interested) there is every reason to believe amounted to a much larger number. Of the former, 270 were extinguished by the inmates of the premises without external aid; 398 were extinguished by the inmates assisted by casual voluntary aid; while the extinction of 260 devolved upon the firemen. The total number of calls given at the Engine Stations were 1,159, as shown by the following Table:—

MONTHS.	Number of Fires.	Fatal Fires.	Lives Lost.	Chimneys on Fire.	False Alarms.
January	63	1	3	9	9
February	65	1	1	10	8
March	80	3	4	13	10
April	65	—	—	9	13
May	81	5	8	12	5
June	82	—	—	9	10
July	74	—	—	10	10
August	77	1	1	3	9
September	89	1	1	7	8
October	62	2	2	10	11
November	83	2	3	13	13
December	107	5	5	11	9
TOTAL	928	21	28	116	115

Instances in which Insurances were known to have been effected upon the building and contents 464
Upon the building only 145
——— contents only 42
No Insurance 277

928

Alarms from chimneys on fire 116
False alarms 115

Making the total number of calls 1159

The number of fatal Fires exhibits an increase on those of the previous year, and the number of lives lost is much greater. The fatal Fires may be classed as follows:—

	Fires.		Lives Lost.
Personal accidents from the ignition of wearing-apparel	10	....	10
Intoxication	6	....	7
Bedding accidentally ignited	2	....	2
Explosion of gunpowder.	1	....	2
Inability to escape from burning buildings	2	....	7
	21	....	28

The two fires last noted, were each of a most distressing character. The first occurred at a quarter-past 2 o'clock on the morning of Wednesday, January 15, at the house of Mr. Caunt, licensed victualler, St. Martin's-lane, known as the "Coach and Horses." When the fire was discovered, there were in the house altogether eleven persons. The fire commenced in the second-floor, from the ignition of the bedding; upon this floor was Mrs. Caunt, her infant, a nurse, and a niece, who all escaped downstairs into the street. Above them, in the attics, slept three of Mr. Caunt's children, Ruth Lowe (a female relative), Nokes the cellarman, the barmaid, and Lowe the potman. Nokes exerted himself in a most praiseworthy manner, and succeeded in extricating Mr. Caunt's eldest son, the barmaid, and potman; who, with himself, got out of the attic window, and over the tiles to the next house. Ruth Lowe, aged 18, as well as Cornelius and Martha Caunt (children of the landlord), were supposed to have escaped; and when it was discovered they had not done so, the fire had attained such a head as to render their extrication impossible,—and they perished in the attic where they slept. Mr. Caunt was at the time out of town. The Royal Society for the Protection of Life from Fire, presented Mr. Nokes with a gratuity and the Society's Silver Medallion, for his intrepid conduct upon this occasion.

The other fatal fire was likewise at a licensed victuallers, on Sunday, May 18, at 2½ A.M., when the "Rose and Crown," No. 17, Love-lane, Lower Thames-street, was discovered to be on fire. The inmates at the time were Mr. Harvey, the proprietor; Elizabeth Grey, his mother-in-law; the potman; a male lodger; and a female-servant. The servant girl on waking found the room full of smoke; she opened the door, but found it impossible to escape by the stairs,—upon which she precipitated herself out of the back-window and fell upon a skylight at the back of the White Hart Tavern, into which she was assisted, and, being much cut by the glass was taken to Guy's Hospital. The other inmates of the burning buildings were never seen or heard of until the fire was extinguished; when their lifeless remains were discovered in the apartments in which they slept, and which they had not quitted. With one exception, they appear to have been burned in their beds.

The attendance of the Fire-escapes, and Fire-engines was proved to have been most promptly obtained; but the fire had got such a mastery, before discovered, as to defy all human exertion to effect the rescue of the inmates, or to save much of the premises from destruction.

The Royal Society for the Protection of Life from Fire have been eminently successful in their operations during the past year; their Fire-escape Conductors having been in attendance at 249 fires, and effected the saving of 24 lives; viz.,—

	Lives Saved.
January 3, Arthur-street, St Giles	1
February 5, Strand	2
March 19, Fashion-street, Spitalfields	2
,, 22, Sun-street, Bishopsgate,...	2
April 3, Rood-lane, Fenchurch-street	3
Oct. 26, Montague-st., Portman-square	5
Nov. 6, Mint-street, Southwark	3
,, 21, Tyssen-street, Bethnal green.	5
Dec. 7, Tottenham-street	1
	24

Several of these cases were of a highly meritorious character, and the exertions made such as could have been afforded only by well-trained men.

During the past year, four new Stations have been furnished with Fire-escapes: viz., Westminster-road, Kennington-cross, Hyde-park Corner (north-east), and Euston-square, St. Pancras,—making the present number of Stations, 32. Other additional Stations have been decided upon; and the Metropolis will, it is hoped, at no very distant period be protected by a continuous chain of Fire-escapes, at half-mile distances throughout, attended, nightly, by a properly-appointed Conductor, skilled in the use of his machine and prepared to render all needful assistance in case of fire.

It is a matter of congratulation that the public are beginning to attach due importance to this highly useful force, and to de-

sire its extension to localities hitherto unprovided with Fire-escapes. It only remains with the public to provide the requisite funds; the Royal Society are quite prepared to do their part in providing a systematised arrangement of Fire-escapes and Conductors, and maintaining the same in an efficient state.

The following List shows the Occupancy of that portion of the Premises in which the Fire originated; illustrating the comparative liability to Accident by Fire of the various Trades, Manufactories, and private Dwellings:—

Occupation.	Totally Destroyed.	Seriously Damaged.	Slightly Damaged.	Total.
Apothecaries (no laboratories)	..	2	..	2
Accoutrement-makers, army	..	1	..	1
Bakers	1	1	9	11
Ditto, sea biscuit	..	2	..	2
Barge and boat-builders	..	1	1	2
Basket-makers	1	..	..	1
Bath-keepers	..	1	..	1
Beer-shops	..	3	12	15
Blacking-makers	..	..	1	1
Booksellers, binders, and stationers	..	2	6	8
Bottle-merchants	..	1	..	1
Brewers	..	2	..	2
Brokers, and dealers in old clothes	..	3	5	8
Builders	3	5	3	11
Butchers	..	..	1	1
Cabinet-makers	..	5	7	12
Calenderers	..	1	..	1
Caoutchouc-manufacturers	..	..	1	1
Carpenters, and workers in wood (not cabinet-makers)	..	17	19	36
Chandlers	1	3	10	14
Charcoal and coke, dealers in	..	..	1	1
Cheesemongers	..	5	3	8
Chemists (including laboratories)	..	1	1	2
Churches	..	..	1	1
Cigar-makers	..	1	1	2
Coach-makers	..	1	1	2
Coal-merchants	..	..	1	1
Coffee-roasters	..	..	2	2
Coffee-shops and chop-houses	..	4	9	13
Confectioners and pastry-cooks	..	2	2	4
Coopers	..	1	3	4
Cork-cutters	..	1	..	1
Corn-chandlers	..	3	1	4
Cotton wool, workers in	..	..	1	1
Curriers and leather-dressers	..	..	1	1
Distillers, spirit	..	2	..	2
———, tar	..	1	1	2
Drapers, linen, woollen, and mercers	1	11	11	23
Druggists, wholesale	..	1	2	3
Dwellings, private	1	43	332	376
Eating-houses	..	..	7	7
Exhibition, the Great	..	..	1	1

Occupation.	Totally Destroyed.	Seriously Damaged.	Slightly Damaged.	Total.
Farms	1	6	..	7
Fellmongers	..	1	..	1
Felt-makers	..	1	..	1
Firewood manufacturers, patent	1	1	..	2
Firework-makers	..	2	1	3
Fish-curers	..	2	1	3
Furriers and skin-dyers	..	2	..	2
Gaming-house	..	..	1	1
Gas-works	..	..	1	1
Glass-blowers	..	..	1	1
—— cutters	1	..	2	3
Glass and emery-paper makers	..	..	1	1
Glue-makers	..	..	1	1
Grocers	..	7	7	14
Gutta-percha manufacturers	..	..	1	1
Hat-makers	..	3	2	5
Horse-hair merchants	..	..	1	1
Hotels and club-houses	..	1	7	8
Japanners	..	4	2	6
Lamp-black makers	..	..	1	1
Laundresses	..	1	..	1
Lucifer match-makers	..	2	2	4
Marine stores, dealers in	..	3	4	7
Mills, steam	..	..	2	2
Milliners and dress-makers	..	4	10	14
Musical instrument-makers	1	2	1	4
Nurserymen	..	1	..	1
Oil-works	..	2	..	2
Oil and colour-men (not colour-makers)	..	6	4	10
Painters, plumbers and glaziers	..	..	2	2
Paper-stainers	..	1	..	1
Parchment-makers	..	1	..	1
Pasteboard-makers	..	1	..	1
Pawnbrokers	..	..	1	1
Perfumers, manufacturing	..	1	..	1
Pork-butchers	..	1	5	6
Potteries	..	2	..	2
Preserved provision-manufacturers	..	1	..	1
Printers	..	6	10	16
——, muslin	..	..	1	1
Public buildings	..	..	1	1
Public places; not theatres	..	2	2	4
Rag-merchants	..	..	1	1
Railways	..	1	4	5
Rope-makers	..	..	1	1
Sack-makers	..	1	..	1
Sale-shops and offices	1	7	26	34
Saw-mills, steam	..	1	6	7

Occupation.	Totally Destroyed.	Seriously Damaged,	Slightly Damaged.	Total.
Schools	..	2	2	4
Scum-boiler	..	..	1	1
Ships	..	..	3	3
Ship-builders	..	..	2	2
—— chandlers	..	..	1	1
Soot-merchants	..	..	3	3
Stables	2	8	9	19
Straw bonnet-makers	..	..	1	1
Tailors	..	..	1	1
Tallow and wax-chandlers, melters and soap-boilers	..	4	3	7
Tanners	..	3	..	3
Timber-merchants	..	1	..	1
Tinmen, braziers, and smiths	1	4	11	16
Tobacconists	..	1	3	4
Toy warehouse-men	..	..	1	1
Under repair, or building	3	4	10	17
Upholsterers	..	1	2	3
Varnish-manufacturers	..	2	1	3
Victuallers, licensed	..	14	14	28
Wadding-manufacturers	..	1	..	1
Warehouses	2	1	2	5
————, French fancy	..	1	..	1
————, furniture	..	1	..	1
————, Manchester	..	..	1	1
Waterproof canvas-maker	..	2	..	2
Weaver, carpet	..	..	1	1
———, willow	..	..	1	1
Wharfs	..	..	1	1
Wine and spirit-merchant	..	..	7	7
Workshops (not hazardous)	..	1	1	2
TOTAL....	21	255	652	928

The Daily distribution of last year's Fires was as follows:—

Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.
135	134	149	123	126	150	111

Their distribution through the hours of Day and Night has been in the following proportion:—

	First hour.	Second hour.	Third hour.	Fourth hour	Fifth hour.	Sixth hour.	Seventh hour.	Eighth hour.	Ninth hour.	Tenth hour.	Eleventh hour.	Twelfth hour.
A.M.	60	49	41	32	18	21	20	15	16	21	19	23
P.M.	31	23	21	28	41	35	55	65	75	91	78	58

The causes of Fire, so far as could be satisfactorily ascertained, may be stated as follows:

Accidents, unforeseen, and for the most part unavoidable	9
Apparel ignited on the person	11
Aërolite	1
Candles, various accidents with	87
———, ignited bed curtains	75
———, ignited window curtains	73
Carelessness, palpable instances of	17
Charcoal fires	2
Chicory-roasting	1
Children playing with fire	11
——— ——— lucifers	7
Cinders put away unextinguished	9
Coke ditto ditto	1
Coppers improperly set	9
Fire sparks	59
—— kindled on hearths and other improper places	9
Fireworks, making	2
————, letting off	3
Flues, foul and ignited	34
——— ——— in adjoining houses	11
——, defective or overheated	35
——, of hot-air stoves	4
——, blocked up	8
Fumigation, incautious	5
Furnaces	16
Gas, escape of, from defective fittings	56
——— ——— street mains	1
Gas, burning too high, or in proximity to inflammable goods	14
Gas stoves	2
—— fittings, repairing of	3
Gunpowder, explosion of	1
Hearths, defective	3
———, fires raked out on	5
Intoxication	13
Kiln	1
Lamps, oil	3
———, naphtha	5
Lime slacking	9
Linen, drying or airing before fires	55
Locomotive engines, sparks from	7
Lucifer matches, making	3
——— ———, using	7
——— ———, accidentally ignited	2
Oil, boiling of	3
Ovens, defective, overheated, &c.	4
Pitch and tar, boiling of	9
Reading in bed	3
Shavings, loose, ignited	39
Smoking meat and fish	5
Spirits, bottle of, bursting by heat	1
Spontaneous ignition of dung	2
——— ——— ——— hay	1
——— ——— ——— lampblack	3
——— ——— ——— lucifers	1
——— ——— ——— oily rubbish	5
——— ——— ——— rags	3
——— ——— ——— tan	1
Stills (1 illicit)	2
Steam boiler, heat from	3
———, bursting of	1
Stoves, improperly set, defective and overheated	27
———, drying	7
———, ironing	2
———, pipe	8
Suspicious	13
Tallow and wax, melting of	4
Tobacco, thrown about unextinguished	29
Varnish, boiling of	3
Wilful	19
	887
Unknown	41
TOTAL	928

It will be seen that one fire is attributed to the fall of an aërolite. This happened September 20th; on which evening, at about half-past 9 o'clock, a brilliant meteor was seen to pass rapidly through the atmosphere, apparently in a state of intense ignition, and fall at the back of the houses in Mount-row, Westminster-road. In about ten minutes afterwards, the workshops of Mr. Downie, picture-frame maker, were discovered to be on fire, from some otherwise unknown cause, and were entirely destroyed before any assistance could reach the spot. The dwelling-house, although much injured, was saved by the firemen.

Sparks from locomotive engines have, during the year, caused several serious conflagrations—an evil which was foreseen when railways were first proposed to be introduced into the heart of the metropolis, and which occasioned the exclusion of locomotives, in the first instance, from the Blackwall line. Of late, however, they run to and fro, snorting and belching forth fire as if it were the most harmless thing in nature. While the blissful ignorance of people appropriates the arches of the railways and the open yards along either side of the line to the depository of hay, straw, timber, and other highly combustible matters! Did the reader ever, on a dark night, while travelling by rail, notice the manner in which the burning coke from the furnace of the locomotive is thrown about? Occasionally, struck by the spokes of the rapidly-revolving wheels, the burning mass is projected through the air to a distance of many yards, igniting whatever combustible is within reach.

A conflagration of this origin, September 18th, destroyed a valuable stock of deal, mahogany, and other wood on the premises of Mr. Robinson, North-street, Bethnall-green, seriously injured four arches of the Eastern Counties Railway, and destroyed the electric telegraph wires and posts.

Several of last year's fires were proved to have been wilfully occasioned, and in some cases the incendiaries were brought to justice. In one instance of *carelessness*, the Act of Parliament, which imposes a penalty of 1,000*l.*, or imprisonment for eighteen months, on any servant negligently setting fire to a house or outhouse, was put in force. It appeared that, on the 18th October, a carpenter named Burridge was covering the roof of a shed in St. Ann's-place, Limehouse, with canvas and pitch. Whilst Burridge was engaged upon the roof, the pitch-pot boiled over, and set fire to the premises, which were in the occupation of Mr. Chapman, potter, and before assistance could be obtained they were destroyed. The premises belonged to Mr. Flight (proprietor of the "Preserver Fire-office," and consequently his own insurer), who charged Burridge with negligently causing the loss which fell upon him, before Mr. Yardley, the Magistrate.

Mr. Yardley observed that the statute was a highly penal one, and it was important that servants and labourers should know the serious responsibilities incurred by negligence in case of fire; in the present instance, an extensive loss had been occasioned by the carelessness of the defendant, who left a pot of pitch on the fire without any one to watch it. Taking into account the defendant's previous good character, and the great exertions he made to endeavour to extinguish the flames, the Magistrate inflicted a mitigated penalty of 10*l.*

Fires are continually occasioned by domestic animals, cats, dogs, rats, &c.;* the past year presented a novelty in the

Remarkable Discovery of a Fire by a Horse.

On Thursday, February 13th, about 1 A.M., intelligence was given at the Fire-engine Stations in London, that a fire had broken out in Grove-street, Deptford, at the "Ship Defiance" public house. This fire was, however, promptly extinguished by the inmates and police. The messenger who gave the alarm at the West of England Fire-engine Station made a mistake, saying *Globe*-street. The engine was instantly horsed and started; and *Globe*-street, Deptford, not being known to the firemen, they kept the high-road, trusting to the receipt of more precise and accurate information as they approached Deptford. Proceeding along at their usual rapid rate, they reached High-street, Deptford, when, all of a sudden, one of the engine-horses came to a dead stop, and refused to move a step further; encouraging words and the whip were resorted to, but the only result was the horse's throwing himself on his haunches. Surprised at this extraordinary occurrence, curiosity was excited, when one of the firemen, addressing Mr. Connorton, the Superintendent, exclaimed—"Good God! *this* house is on fire," pointing at the same time to the house opposite which the horse had so unaccountably stopped. The premises in question belonged to Mr. Wright, seedsman and corn-chandler, and, on looking through the fan-light, the fire was found raging in the shop. The firemen instantly roused the neighbours; and having collected a number of pails filled with water, they then broke open the shop-door, and had nearly extinguished the fire before the policeman on the beat knew of the occurrence.

The Fires of the Year

Were undoubtedly those which destroyed the warehouses of Alderman Humphry, in Tooley-street and Montague-close, Southwark; the former of which broke out on Wednesday, February 19th, at 3 A.M.—the latter on Monday, June 23rd, at 4 o'clock in the afternoon. The first fire commenced in the dwelling-house of Mr. Wigan, hop-merchant, in Duke-street, from whence it travelled into the extensive warehouses behind. The great height of these premises from Tooley-street rendered it impossible to throw any quantity of water on to the upper floors, and the flames raged with uncontrolled fury for several hours. As the fire progressed downward, it came within the range of the engines; but by that time, the accumulated mass of burning matter defied extinction. The two floating engines and nine land engines belonging to the London Brigade, and one belonging to the West of England office, were kept at work for hours to prevent the fire from spreading to the extensive oil stores and other inflammable property contiguous; and in this they were successful, but it was many weeks before the fire was wholly extinguished.

The second fire began in one of four warehouses marked A, B, C, and D—being first seen in the third floor of the eastern warehouse, A, in the rag-stores of Messrs. Hollingsworth, from whence the flames spread with great rapidity. The two floating engines, eleven land engines of the Brigade, the West of England engine, and one from Messrs. Barclay's brewhouse, were promptly in attendance and got into operation, but under most disadvantageous circumstances, owing to the scanty supply of water within any rea-

* A case of incendiarism by a jackdaw has just been reported.

sonable distance of the fire. The great lengths of hose attached to the land and floating engines made it exceedingly difficult to offer any effectual check to the progress of the flames. The warehouse A was almost entirely destroyed, and a large portion of the warehouse B, by 7 o'clock, by which time, however, the firemen had got the mastery, and no farther damage was anticipated. To the consternation of all present, however, it was then discovered that another distinct fire had broken out in the fourth (D) warehouse. The firemen, exhausted by four hours' arduous labour, were quite unable to meet this unexpected demand for renewed exertion, and the increased distance from the water-supply, magnified the difficulties of their position. The engine from Messrs. Barclay's brewhouse, being most advantageously placed in front of the D warehouse, was worked with much spirit, but unfortunately produced no effect upon the flames, which raged most furiously, burning downward from floor to floor with surprising rapidity. The intense heat speedily ignited the scaffolding of the Hibernia wharf, which was re-building, and but for the activity and well-directed exertions of Mr. Connorton with the *West of England* engine, the whole range of premises on the river-side would assuredly have been destroyed. The admirable working of this engine, and its skilful management, had been the subject of universal approbation in the early part of the afternoon; but these performances were eclipsed by those of the later and more trying emergency of the evening. In consequence of the great number of hours this fire was burning, an immense crowd of spectators had assembled—many of them foreigners and men of science, who were not very favourably impressed with the operations of the London firemen, acting as they were under the greatest disadvantages, and in numbers wholly inadequate to the requirements of such a conflagration;—there were but fifty present!

The Risks of Fire Insurance

Are still far from settled; what with a disposition to excessive competition on the one hand, reducing the rates too low, and the efforts of monopoly to keep them too high on the other, but little progress towards an equitable adjustment has yet been made. It was remarked by the newspaper press, that "the insurance-offices reaped a bountiful harvest out of the *Exhibition*." The *actual risk* in a building composed almost entirely of iron and glass, filled with articles five-sixths of which were incombustible, guarded day and night by firemen, police, and sappers,—throughout which a supply of water, under pressure, was judiciously disposed, and within which about fifty fire-engines of one sort and another were located—could not have been very great!

One shilling per cent. (for six months) would have been ample compensation for such an infinitessimal risk. The tariff agreed upon, and actually charged upon a large amount of property, was ONE GUINEA!!!

Towards the close of last year, an attempt was made by Mr. Ford, the managing Director of the Sun Fire-office, to induce the older fire-offices to combine against the "Newly-established Companies," and "adopt a reduced tariff *for a time*" on certain classes of insurance, "so that all offices may act upon as much of an equality as possible; or if the new companies adopt a still lower scale of rates, they should be such as would not yield any profit, but speedily entail a certain loss upon them." To the letter written by Mr. Ford, requesting the Directors of the Manchester Fire Assurance-office to join him in this crusade, a most masterly reply was sent by their Secretary, in which he says, "I am unable to advise my Board to concur either in the proposition made in your letter, or in the principle it involves. The proposition appears to be no less than that the older fire-offices should combine to ruin and break up the younger ones by insuring risks at unremunerating and ruinous rates, depriving (as a consequence) the public of the advantage of competition—a thing simply impossible.

"The principle involved appears still more objectionable; for to attempt to crush and put down the younger offices by forcing them to adopt so low a scale of rates 'as (to quote from your favour) would not yield any profit, but speedily entail a certain loss upon them,' would be manifestly unjust; and the effect of such an injustice (if attempted) would be to secure for them a larger share of public support and sympathy than they would otherwise expect to receive.

"I therefore feel that upon reflection you will see that the best interests of all the offices will be consulted by the abandonment of an idea that will not bear the test of investigation. Should, however, your office, or indeed any other respectable company, be in a position to show the present rates of any class of risks are too high, or too low, it will afford this Company great pleasure to investigate the same, and re-adjust the respective tariffs."

Mr. Ford attempted to deny, "that the older offices intended to combine to ruin and break up the younger ones;" observing, in conclusion, that as "you do not agree in opinion with me, I shall defer for the present to call a meeting of the offices; but I

shall be watchful of the course which the New Companies are taking, and shall regulate my proceedings accordingly.*

The Inefficiency of the present Floating-engines

Having long been notorious, and this fact having received a melancholy corroboration at the burning of each of Alderman Humphrey's warehouses, before narrated, it has been determined to apply steam power to one of them, by way of experiment. The steam engine is to be made available for working the fire engines, as also for propelling the boat; but as neither paddle-wheels nor screw are to be applied, probably propulsion by the jet will be attempted. It will be peculiarly unfortunate, after all, that in a vessel where speedy transit is of such vital importance, any imperfect system of propulsion should be resorted to; and the employment of a jet for that purpose (although the subject of several current patents), has never yet been found practically advantageous.

Islington, March 9, 1852.

ON THE HYPOTHESIS RELATIVE TO LUMINOUS ETHER, AND AN EXPERIMENT WHICH SEEMS TO DEMONSTRATE THAT THE MOTION OF BODIES CHANGES THE VELOCITY WITH WHICH LIGHT IS PROPAGATED WITHIN THEM. BY M. H. FIZEAU.

(Concluded from p. 236.)

All these movements of the water were produced in a very simple manner, each tube being in communication by means of two branches placed near its extremities, with two glass reservoirs, on which pressure was alternately exercised by means of compressed air. Under this pressure, the water passed from one reservoir to the other through the tube whose two extremities were closed by glasses. The interior diameter of the tubes was 5·3 m. (2·087 inches), their length 1·487 m. (4 feet 10 inches); they were of glass.

The pressure under which the flow of the water took place was perhaps more than two atmospheres. The velocity was calculated by dividing the volume of water passed over in one second by the area of the section of the tube. I should say for the purpose of anticipating an objection which might be made, that the greatest care was taken to avoid the effects of accidental movements which the pressure and shock of the water might have produced. Thus the two tubes and the reservoir, where the motion of the water took place, rested on supports independent of the other portions of the apparatus, and particularly of the two telescopes, and it was therefore the tubes only which could receive an accidental movement; but both reason and experience have shown that the movements or bending of the tubes alone were without influence on the position of the fringes. The result of the observations made, is as follows:

When the water is set in motion its fringes are displaced, and according to the direction in which the water moves, the displacement takes place to the right or to the left.

The fringes are displaced towards the right, when the water flows from the observer in the tube situated on his right, and towards the observer in the tube situated on his left.

The fringes are displaced towards the left, when the direction of the current in each tube is opposite to that just indicated.

With a velocity of the water equal to two metres per second, the displacement is already very perceptible; with velocities of from four to seven metres, it becomes perfectly susceptible of being measured after having verified the existence of the phenomenon. I endeavoured to ascertain its numerical value with as much exactitude as was possible, calling a *simple* displacement thatwhich is produced when the water previously in repose was just set in motion, and a *double* displacement that which is produced when the motion has just been changed to a contrary motion. We find by a mean deduced from nineteen observations, differing but slightly from each other, 0·23 for a simple displacement, which gives 0·46 for a double displacement, the width of the fringe being taken for unity. The velocity of the water was 7·069 m. per second.

This result is afterwards compared with those which are deduced by calculation from the divers hypotheses relative to the ether.

On the supposition that the ether exists free and independent of the motion of bodies, the displacement should be nothing.

On the hypotheses that the ether is united to the molecules of bodies, so as to partake of their motion, the calculation gives for the double displacement the value of 0·92. The observation gave a number one-half smaller, or 0·46.

On the hypothesis that the ether is partially carried along, according to the theory of Fresnel, the calculation gives 0·40, that is to say, a number very approximately that which has been found by observation. And the difference between these two values would have been very probably still less,

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* The detailed correspondence was printed in the *Times*, November 21, 1851.

had it been found possible to introduce into the calculation of the velocity of the water a correction necessarily neglected for want of data sufficiently precise, and depending on the unequal velocity of the different liquid filaments: in estimating the value of this correction in the most probable manner, we see that it tends to augment a little the theoretic number, and to approximate still more its value to the result of the observation.

An experiment similar to that just reported had been previously made with air in motion, and I had ascertained *that the motion of the air produces no sensible displacement in the fringes*. Under the circumstances in which this experiment was made, and with the velocity of 25 metres per second, which was that given to the motion of the air, we find in the hypothesis that the ether was carried along, that the double displacement should have been 0·82.

According to the hypothesis of Fresnel, the same displacement should have been but 0·000465,—that is to say, altogether insensible. Thus the apparent immobility of the fringes, with the air in motion, is altogether in accordance with the theory of Fresnel.

It was after having verified this negative fact, and in the endeavour to explain the divers hypotheses relative to ether, in such a manner as to make them accord at the same time with the phenomenon of aberration, and with the experiment of M. Arago, that it appeared to me necessary to admit with Fresnel, that the motion of bodies occasions a change in the velocity of light, and that this change of velocity is greater or less for different mediums, according to the energy with which these mediums refract light, so that it is considerable in bodies of great refractive power, and very feeble in those which refract less, as the air.

It results from this, that if the fringes were not displaced when the light traversed air in motion, we should, on the contrary, have a very sensible diplacement, in making the experiment with water whose index of refraction is much greater than that of air.

An experiment, for which we are indebted to M. Babinet (published in vol. ix. of the "Comptes Rendus de l'Academie des Sciences"), appeared to be in contradiction with the change of velocity in conformity with the law of Fresnel. But in considering the circumstances of this experiment, I have remarked the existence of a cause of compensation which should render insensible the effect due to the motion: this cause arises from the reflection which the light undergoes in this experiment; in fact, we can demonstrate, that when two rays have relative to each other a certain difference of phase, this difference is altered by the effect of the reflection from a mirror in motion. Now, in calculating separately the two effects in the experiment of M. Babinet, we find that they have values sensibly equal, and contrary signs.

This explanation renders still more probable the hypothesis of the change of velocity, and an experiment made in water in motion appears to me proper in every respect to decide the question with certainty.

The success of this experiment seems to me to necessitate the adoption of the hypothesis of Fresnel, or at least of the law which he has discovered to express the change of the velocity of light by the effect of the motion of bodies; for although, should this law be found true, it would be very strong proof in favour of the hypothesis of which it is but a consequence, perhaps the conception of Fresnel will appear so extraordinary, and in some respects so difficult to admit, that still further proofs, and a profound examination on the part of mathematicians may be demanded before adopting it as the expression of the reality of things.

PATENT LAW CASE.—ROLLS' COURT, MARCH 24.

Newall v. Wilson.

Mr. Roupell, with whom were Mr. Roundell Palmer and Mr. Cairns, moved on the part of the plaintiff, Robert Stirling Newall, for an injunction to restrain the defendant, James Buck Wilson, his workmen, servants, and agents, from making, using, selling, or disposing of any wire metallic rope made according to the invention of the plaintiff in infringement of the letters patent granted to the plaintiff for the manufacture of untwisted wire rope. A mode of making wire rope had been published in Germany by a Mr. Albert, an engineer, and ropes were manufactured upon his principle in the Hartz Mountains. Albert's mode of making wire rope was afterwards translated and published in the *Mining Journal*. In 1840 the plaintiff obtained a patent for making wire rope in the manner there described, and in two instances where he had brought actions at law for alleged infringements he sustained his right to the patent. In 1851 the defendant engaged a workman named Pattinson, who had been in the plaintiff's employment, and with his assistance began to manufacture wire rope, which was now complained of by the plaintiff as an infringement of his patent, and who alleged that the present application was necessary,

inasmuch as the defendant was not in a condition, with respect to pecuniary means, to pay the plaintiff damages occasioned by the infringement, if he proceeded against him at law.

His HONOUR, during Mr. Roupell's opening, expressed an opinion that the plaintiff should have proceeded at law, and the only question now was whether he should grant the injunction in the mean time till such proceedings were taken.

Sir Alexander Cockburn and Mr. Selwyn appeared for the defendant.

At the conclusion of the plaintiff's case,

His HONOUR asked if the defendant would undertake to pay any amount of damages the Court might award to the plaintiff if it came to the conclusion that his patent had been infringed, and also undertake to keep an account in the mean time. If so, he would not grant the injunction, but otherwise he must grant it till the trial at law had taken place.

Sir A. COCKBURN having assented,

His HONOUR said, under those circumstances, there must be an action brought at law to try the validity of the plaintiff's patent, and the defendant must keep an account till that action was decided. The motion must stand over in the mean time.

COURT OF CHANCERY.

LINCOLN'S-INN, MARCH 25. (*Before the* LORDS JUSTICES OF APPEAL.)

Mr. CAIRNS at the sitting of the Court asked for leave to give notice of motion for an appeal from a decision made by his Honour the Master of the Rolls, refusing an order for an injunction to restrain the defendant, Mr. James Buck Wilson, from infringing the patent of the plaintiff, Mr. Robert Stirling Newall, dated in 1840, for improvements in the manufacture of ropes of untwisted wire. The learned counsel stated that the Master of the Rolls, notwithstanding the length of enjoyment, and notwithstanding the fact that the patent had been twice successfully defended at law against invasion, did not think he ought to interfere by way of injunction until the right had been established again at law.

Lord Justice KNIGHT BRUCE.—What reason is there for asking an early day?

Mr. CAIRNS said it was of the utmost importance to the patentee that his title should not be left a single unnecessary moment in doubt.

Lord Justice Lord CRANWORTH had no objection that the case should be put into the paper for Monday, but the parties must take the chance of the Court being able to dispose of it on that day.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MARCH 24, 1852.

JOHN BLAIR, of Irvine, Ayr, North Britain, gentleman. *For certain improvements in beds or couches, and other articles of furniture.* Patent dated September 10, 1851.

Claims.—1. Certain systems or modes of securing strength and portability in the framework and other details of beds, couches, and other articles of furniture.

2. The general arrangements described of mechanism, apparatus, or means of the obtainment of portability in the framework and other details of beds, couches, and other articles of furniture.

3. The application and use of a recess in angle iron framework for the reception of the minor details of bed and other furniture.

4. A system or mode of constructing the framing of beds, and other articles of furniture, with horizontal and other folding joints.

5. The application and use of diagonal or inclined supporting legs.

6. The application and use of longitudinal and transverse stays to connect the diagonal legs to framings.

7. The application and use of gutta percha bands or supports for bedding.

8. A system or mode of attaching the bedding support, or bedding itself, to the framework.

9. A system or mode of attaching the bedding, or bedding supports, to the framework by means of connecting hooks.

10. The application and use of "wedge dovetail" joints for connecting the framing of beds and other articles of furniture.

11. A system or mode of constructing flush corner joints of bed frames.

12. A system or mode of forming the end connecting flanges for the corner joints, by turning down a portion of the flange of the angle iron itself.

13. A peculiar arrangement of tent coverings and curtains for portable bedsteads.

WILLIAM JEAN JULES VARILLAT, of Rouen, France, manufacturing chemist. *For improvements in the extraction and preparation of colouring, tanning, and saccharine matters from various vegetable substances, and in the apparatus to be employed therein.* Patent dated September 11, 1851.

The improvements claimed under this patent comprehend,

1. A peculiar arrangement of cutting machinery having one or two cylinders carrying cutting blades for chipping and shaving dyewoods.

2. An arrangement of apparatus for dis-

solving and separating the soluble portions of vegetable substances from the insoluble matters with which they are combined, by the use of hot water at a temperature less than 100° Centigrade (212° Fahr.)

3. An arrangement of apparatus for evaporating in a vacuum, with double and triple effect, by means of the waste steam of an engine, or other steam expanded at less than 100°, working by the differential vacuum of one apparatus to the other (the same being a new principle.)

4. An arrangement of apparatus for concentrating and solidifying the products of the preceding operations, having an agitator in the vacuum, with a heat less than 100°.

5. A system or mode of producing extracts, wherein, throughout the entire process, the heat is never raised so high as 100°, nor the materials under treatment exposed in any way to a higher temperature.

George Phillips, of Upper Park-street, Islington, chemist. *For an invention for preventing the injurious effects arising from the smoking of tobacco.* Patent dated September 18, 1851.

It is well known that tobacco contains two highly poisonous constituents, nicotine and nicotianine, which are distilled over with the volatile oil during the act of smoking, and when introduced into the system tend much to the injury of the health and comfort of the smoker. The former of these products is volatilised at 320°, and the latter at 212° Fahrenheit. Now the object of the patentee is to intercept, cool down, and condense these noxious oils; and this he effects by causing the smoke to traverse worms, or plates of metal, or surfaces of wool, cotton, or other suitable fibrous material, or discs of woven fabrics, or saw-dust, pumice, or other porous material, which will permit the passage of the smoke, but intercept and condense the volatile oils; and he prefers for this purpose to use the material known as "wool in grease." He also saturates the fibrous or other material employed with fats or fixed oils, which he finds to act effectually in condensing the noxious products in tobacco smoking. The same effect may be produced by using alkaline solutions, but the patentee does not recommend their adoption, as they are found to destroy the true taste of the smoke. The fibrous materials, lightly packed, are placed in a stem of glass, in which they are retained by perforated corks, and they are introduced into the stem at about the middle of its length, so as to allow room for the mouth-piece and bowl to be attached.

The bowl is formed with a stem, which is introduced into the glass tube, and the space left between the interior of the tube and the stem of the bowl constitutes a reservoir, which serves to contain the condensed oils, &c., and prevents their return into the bowl; and sometimes the stem of the bowl has a cup attached to its end, to prevent the oil passing into it. The mouth-piece is fitted in a similar manner—that is, it has a stem which projects into the tube so as to prevent any condensed oil from passing into the mouth of the smoker. The improvements are also shown as adapted to meerschaums, and the tubes may be fitted so as to admit of holding cigars. The patentee also in some cases introduces a wet sponge in the tube at the top, for the purpose of obtaining a water pipe.

Claims.—1. The use of any suitable material or substance applied to the various modes of cooling down the smoke, condensing the oils, and filtering them from the smoke. Also, the use of fixed oils and fats for the purpose described.

2. The construction and arrangement of the several parts of a pipe, as shown. Also, the mode of adapting the bowl of a pipe to the tube, so as to form a reservoir for the reception of the condensed oils, &c. Also, the mode of forming the reservoir at the bottom and top of the tubes for meerschaums. And also the mode of applying a wet sponge at the top of the tube to form a water pipe.

John Wormald, of Manchester, maker-up and packer. *For improvements in machinery or apparatus for spinning and doubling cotton, wool, silk, flax, or other fibrous substances.* Patent dated September 18, 1851.

Claims.—1. The construction of machinery for spinning and doubling with horizontal spindles and flyers having a loose tube, on which the thread or yarn is wound adapted thereto.

2. The adaptation of flyers of a conical shape, having a tube, tubes, or conductors, through which the sliver or yarn is passed, to spinning and doubling machinery.

3. The construction of the carriage with a peculiar carriage and cop motion.

4. Certain arrangements whereby the necessary drag for preventing snarling of the thread is produced.

5. The fixing spindles with revolving tubes, in manner described.

6. The construction of machinery or apparatus for spinning and doubling cotton, wool, silk, flax, or other fibrous substances, in the manner, and according to the arrangements represented and described.

John Livesey, of New Lenton, Nottingham, draughtsman. *For improvements in the manufacture of textile fabrics, and in machinery for producing the same.* Patent dated September 18, 1851.

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Froggatt, of Manchester, house and decorative painter, for a certain improvement or improvements in the process of decorative painting, which improvement or improvements are applicable to rooms, halls, carriages, furniture, and other purposes to which decorative painting has or may be applied. March 20; six months.

John M'Dowall, of Walkinshaw Foundry, Johnstone, Renfrew, North Britain, engineer, for improvements in cutting wood and other substances, and in the machinery or apparatus employed therein, and in the application of power to the same parts of which improvements are applicable for the transmission of power generally. March 20; six months.

William Westley Richards, of Birmingham, gun-manufacturer, for certain improvements in fire-arms, and in the means used for discharging the same, also improvements in projectiles. March 20; six months.

William Symington, of Trafalgar-place, West Hackney-road, Middlesex, gentleman, Charles Finlayson, of Manchester, engineer, and John Reid, of the same place, gentleman, for improvements in flues, and in heating air, and in evaporating certain fluids by heated air. March 22; six months.

John Drumgoole Brady, of Cambridge-terrace, Middlesex, Esq., for improvements in helmets, cartridge-boxes, and other military accoutrements. March 22; six months.

Edward Morewood and George Rogers, both of Enfield, Middlesex, gentleman, for improvements in shaping, coating, and applying sheet metal to building purposes. March 24; six months.

John Macintosh, of Berner's-street, Middlesex, civil engineer, for improvements in ordnance and fire-arms, and in balls and shells. March 24; six months.

Antoine Maurice Tardy de Montravel, of Paris, France, gent, for certain improvements in obtaining motive power, and the machinery employed therein. March 24; six months.

Isaac Brookes, of Birmingham, manufacturer, and William Lutwyche Jones, of Birmingham, aforesaid, manufacturer, for certain improvements in stoves, and other apparatus for heating. March 24; six months.

William Whitaker Collins, of Buckingham-street, Adelphi, civil engineer, for certain improvements in the manufacture of steel. March 24; six months.

William Cole, of Birkenhead, Chester, architect, and Alfred Holt, of Liverpool, Lancaster, civil engineer, for an improved method of preventing and removing the deposit of sand, mud, or silt, in tidal rivers in certain cases, and also in harbours, docks, basins, guts, or other channels, communicating with the sea through tidal rivers, or otherwise, the same being applicable in certain cases to other rivers or moving waters. March 24; six months.

John White and Robert White, of Cowes, in the Isle of Wight, ship builders, for improvements in ship building. March 24; six months.

William Henry Hulseberg, of Mile-end, Middlesex, for certain improvements in the treatment of wool, hair, feathers, fur, and other fibrous substances, and in machinery or apparatus for the same. March 24; six months.

William Archer, of Hampton-Court, Middlesex, gent., for an improved mode, or modes of preventing accidents on railways. March 24; six months.

Thomas Bell, of Don Alkali Works, South Shields, for improvements in the manufacture of sulphuric acid. March 24; six months.

Richard Parris, of Long acre, Middlesex, modeller, for improvements in machinery or apparatus for cutting and shaping cork. March 24; six months.

William Pidding, of the Strand, gentleman, for improvements in the construction of vehicles used on railways, or on ordinary roads. March 24; six months.

Edward Hammond Bentall, of Heybridge, Essex, ironfounder, for improvements in the construction of ploughs. March 25; six months.

John Smith, of Bilston, Stafford, brass founder, for certain improvements in locomotive and other steam engines. March 25; six months.

LIST OF SCOTCH PATENTS FROM THE 22ND OF FEBRUARY TO THE 22ND OF MARCH, 1852.

William Hamer, of Manchester, Lancaster, for certain improvements in looms for weaving. February 23; six months.

Peter Armand Lecomte de Fontainemoreau, of South-street, Finsbury, London, for certain improvements in gas burners. (Communication.) February 26; four months.

Charles John Mare, of Blackwall, for improvements in constructing iron ships or vessels, and steam boilers. March 1; six months.

Henry Glynn, of Bruton-street, Berkley-square and Rudolph Appel, of Gerrard street, Soho, annastatic printer, for improvements in the manufacture or treatment of paper or fabrics, to prevent copies or impressions being taken of any writing or printing thereon. March 1; six months.

William Edward Newton, of Chancery-lane, London, civil engineer, for improvements in the heddles or harness of looms for weaving, and in the machinery for producing the same. (Communication.) March 2; six months.

Henry Bessemer, of Baxter-house, Old St. Pancras-road, Middlesex, for improvements in expressing saccharine fluids, and in the manufacture, refining, and treating of sugar. March 3; six months.

Frederick Crace Calvert, of Manchester, Lancaster, professor of chemistry, for improvements in manufacturing iron, and in manufacturing and purifying coke. March 4; four months.

John Henry Johnson, of Lincoln's inn Fields, Middlesex, and of Glasgow, North Britain, gentleman, for improvements in weaving carpets and other fabrics, and in the machinery and apparatus employed therein. (Communication.) March 4; six months.

William Sinclair, of Manchester, Lancaster, engineer, for certain improvements in locks. March 8; six months.

John Blair, of Irvine, Ayr, North Britain, gentleman, for certain improvements in beds and couches, and other articles of furniture. March 9; six months.

Perry G. Gardiner, of New York, United States, civil engineer and machinist, for improvements in the manufacture of malleable metal into pipes, hollow shafts, railway wheels, or other analogous forms, which are capable of being dressed, turned down, or polished in a lathe. March 10; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in machinery for combing wool and other fibrous substances. (Communication.) March 15; six months.

Alexander Cunningham, of Glasgow, Lanark, North Britain, iron master, for improvements in the treatment and application of slag, or the refuse matter of blast furnaces. March 15; six months.

William Charles Scott, of Camberwell, Surrey, gentleman, for improvements in the construction of omnibuses and other public and private carriages. March 15; four months.

William Stirling Lacon, of Great Yarmouth, Norfolk, gentleman, for improvements in the means of suspending ships' boats, and lowering the same into the water. March 16; six months.

John Mercer, of Oakenshaw, Clayton-le-Moors, chemist, and John Greenwood, of Irwell Springs, Bacup, Turkey-red dyer, both in Lancaster, for certain improvements in preparing cotton and other

fabrics for dyeing and printing. March 17; six months.

Charles Middleton Kernot, of West Cowes, Isle of Wight, doctor of philosophy, and William Hirst, of Manchester, Lancaster, manufacturer, for certain improvements in the manufacture of woollen cloth, and cloth made from wool and other materials, and in machinery or apparatus for manufacturing the same. March 17; six months.

John Ramsbottom, of New Mills, Derby, engraver, for certain improvements in machinery or apparatus for measuring or registering the flow of water and other liquids or vapours, which machinery or apparatus is also applicable to registering the speed of and distance run by vessels in motion, and also in obtaining motive power, and other similar purposes. March 17; six months.

John Wallace Duncan, of Grove-end-road, St. John's Wood, Middlesex, gentleman, for improvements in engines in applying the power of steam or other fluids for impelling purposes, and in the manufacture of appliances for transmitting motion. March 22; four months.

Edward Mosely Perkins, of Mark-lane, London, for improvements in the manufacture of cast metal pipes, retorts, or other hollow castings. March 22; six months.

Charles Barlow, of Chancery-lane, London, for improvements in rotary engines. (Communication.) March 22; four months.

William Pidding, of the Strand, Middlesex, gentleman, for improvements in mining operations, and in machinery or apparatus connected therewith. March 22; six months.

James Joseph Brunet, of the Canal Iron-works, Poplar, Middlesex, engineer, for certain improved combinations of materials in ship-building. (Communication.) March 22; six months.

Emanuel Charles Theodore Croutelle, manufacturer, of Rheims, France, for certain improvements in machinery or apparatus for preparing woollen threads and other filamentous substances for weaving. March 22; six months.

William Symington, of Trafalgar-place, West Hackney, Middlesex, gentleman, Charles Finlayson, of Manchester, and John Reid, of the same place, gentlemen, for improvements in flues, and in heating air, and in evaporating certain liquids by heated air. March 22; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Mar. 18	3184	T. Lepeinteur	College-yard, Worcester	Glove-binding.
19	3185	J. Schloss	Friday-street	Briquet.
,,	3186	H. and S. Schloss	Paris	Vulcan porte-cigar.
20	3187	J. Kimberley	Birmingham	Tenoning or tenanting-chisel.
,,	3188	F. Stammers	Strand	Facilis fastening for trousers and garments.
,,	3189	S. Ellithorn and John Shaw	Preston	Tuning-key.
23	3190	C. and J. Clark	Street, Somerset	Elastic gusset for boots.
,,	3191	J. Roberts and W. Winter	Cotton-hill, Nottingham	Glove-fastening.
,,	3192	George Mullin	Glen-house, Guilford	Ring stone for grinding grain.
24	3193	J. W. and D. Allen	West Strand	Elongating portable iron chair.
,,	3194	J. Macintosh	Glasgow	Self-acting balance-seat for carriages.
25	3195	Thomas Whitehead and Samuel Smith	Leeds / Keighley	Dead spindle.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

Mar. 19	374	Henry Maling, Esq.	Home-office	Elevation sight for ball shooting.
,,	375	Edward Williams	Manchester	Self-acting spring tap.
,,	376	Kerby and Son	Oxford-street	Envelope for books and other articles.
20	377	Edward Warren	Bloomfield-terrace, Hyde-park	Pipe cane.
	378	Edward Warren	Bloomfield-terrace, Hyde-park	Cigar cane.
22	379	G. P. Cooper	Suffolk-street, Pall-mall East	Elliptic shirt collar.
23	380	Louis Schmitthenner	Agar-street, Strand	Breech of a rifle barrel.
,,	381	Louis Schmitthenner	Agar-street, Strand	Rifle bullet, or projectile.
,,	382	Louis Schmitthenner	Agar-street, Strand	Form of rifle groove.
,,	383	Louis Schmitthenner	Agar-street, Strand	Form of rifle groove.
25	384	Chubb and Son	St. Paul's-churchyard	Segmental guard for lock.
,,	385	John Brinsted	Porchester	Union fire-irons.

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Edited by J. C. Robertson, 166, Fleet-street.

SCREW STEAM NAVIGATION.—MAIN'S PATENT.

Fig. 1a.

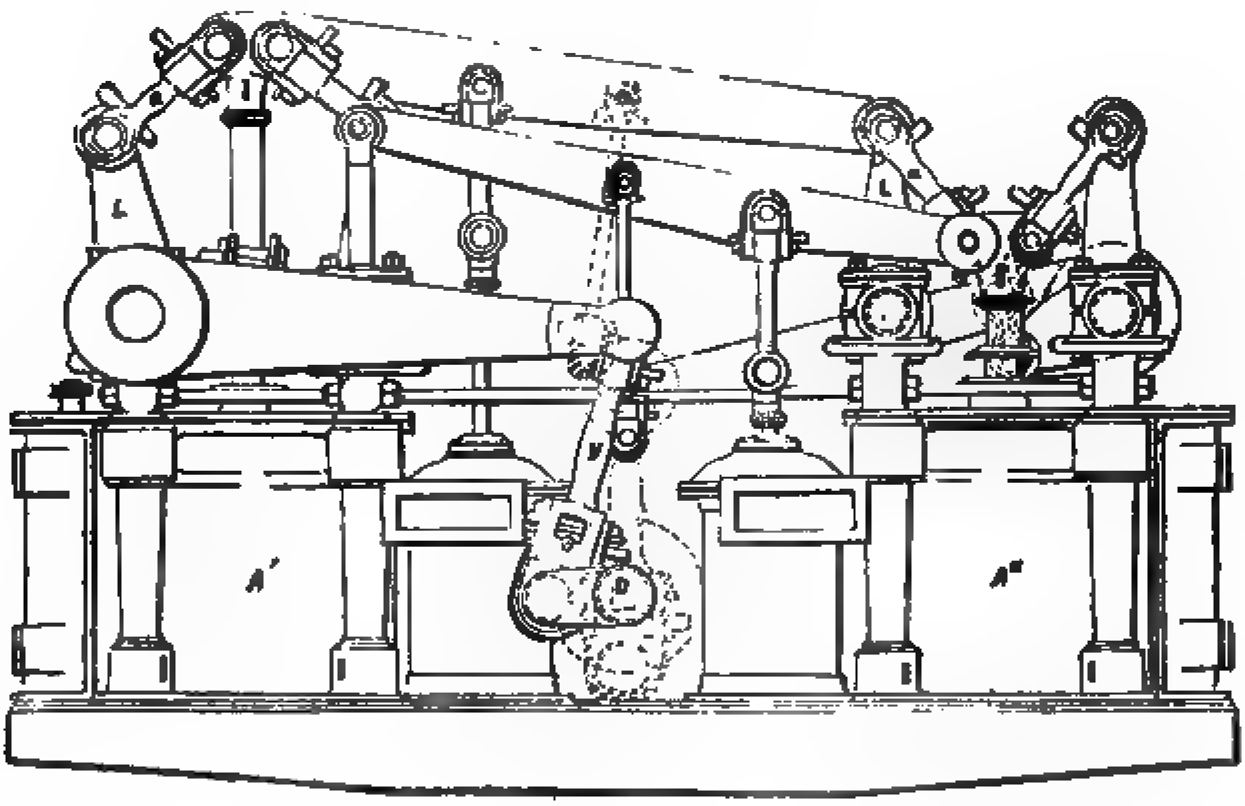


Fig. 2a.

SCREW STEAM NAVIGATION.—MAIN'S PATENT.

The engravings on our front page represents a modification of the Duplex Compensating Engine described in our last Number (the compensating arrangements being omitted), and which may be considered preferable to it, wherever no great power is required and saving of space is an object—the compactness of the engine being such that it occupies a space in the length of a vessel which need only exceed by a very little the diameter of the cylinders. The following description is that given by Mr. Main in his Specification:—

Fig. 1ᵉ is an elevation, and fig. 2ᵉ a plan of this modification. In this case there are only two cranks, placed at right angles on the driving shaft; and the duplex motion is given out by rods and levers from each side of the piston-rod caps, instead of the opposing force being given from the piston-rod caps of the opposite cylinders. The air-pumps have each a stroke, which is a portion of the stroke of the piston, and the bilge and feed-pumps are connected to the cross head of the air-pumps, while the slide valves are worked from a short shaft over the crank or driving shaft. The space which an engine of this description will occupy in the length of the ship need not much exceed the diameter of the cylinder.

SUBSTITUTE FOR THE INTERMEDIATE CRANK-SHAFT IN DIRECT-ACTING MARINE ENGINES.

Sir,—I beg to present to the notice of manufacturing engineers the following substitute, which I have contrived in place of the cranked intermediate shaft, employed for working the air-pumps in direct-acting marine engines.

There is little doubt that the simplest contrivance for this purpose is the said crank-shaft; but, unfortunately, in *very large* engines its manufacture is difficult and expensive, and a failure in perfect soundness involves great delay and cost, and may entirely disable the vessel for several months. Its form, also, does not admit of the production from the hammer, of a forging sufficiently near to the finished dimensions, to prevent the necessity of turning off a large portion of the metal, which, being on or near the surface, is the hardest and strongest part; to say nothing of cutting out the throw into the very heart of the piece and across the grain or fibre of the wrought iron.

Having had much experience at these works in the manufacture of such forgings, sometimes weighing nearly ten tons—and being cognizant of two failures in succession, value 700*l.* each, lately made by a firm in the country under Nasmyth's hammer, which was supposed by some to offer a remedy (not that I mean to infer *any inferiority of effect* in this instrument), and being now engaged in the replacement of one under similar circumstances,—I have endeavoured to find a substitute that might be acceptable to the engineer, by not involving much alteration of the present arrangement of the machinery, or the necessity of an indirect action for the air-pumps.

The most obvious application is that of the common eccentric, but to produce the required stroke of the air-pump, it becomes so large as not only to offer a great rubbing surface at a high velocity, but to present a very awkward appearance.

The method I propose is the addition of a rod jointed at one end to the engine frame, and at the other to the ring of the eccentric, and so placed as to permit the ring to follow the line of vibration of the disc; but as it does not permit the ring to vibrate in the other direction at the point jointed to this holding-rod, it causes the connecting-rod, which is to be jointed to the ring on the opposite side, to perform double the length of stroke of the eccentric, or allows the latter to be reduced one-half; in fact, to about the diameter of those already existing on the intermediate shaft for the valve actions.

Care must be taken to make the ring sufficiently strong to resist any tendency to collapse, or an undue friction would be produced. It is also well to note (what might otherwise at first sight appear detrimental to the plan), that the

resistance is the same on the holding as on the connecting-rod. In place of the holding-rod it might be sometimes convenient to substitute a parallel guide for the joint pin's motion.

The method is, of course, applicable to a great variety of purposes, and it presents the mechanical advantage over the crank and common eccentric, of reducing the oscillation of the connecting-rod one-half; and further, when modified, to work two air-pumps by the one eccentric it avoids the full lift or delivery of both pumps simultaneously,—an evil existing with the cranked shaft. It offers, too, the opportunity of obtaining from it more than one length of stroke; which may possibly be available for expansion valve gear, &c.

Fig. 1.

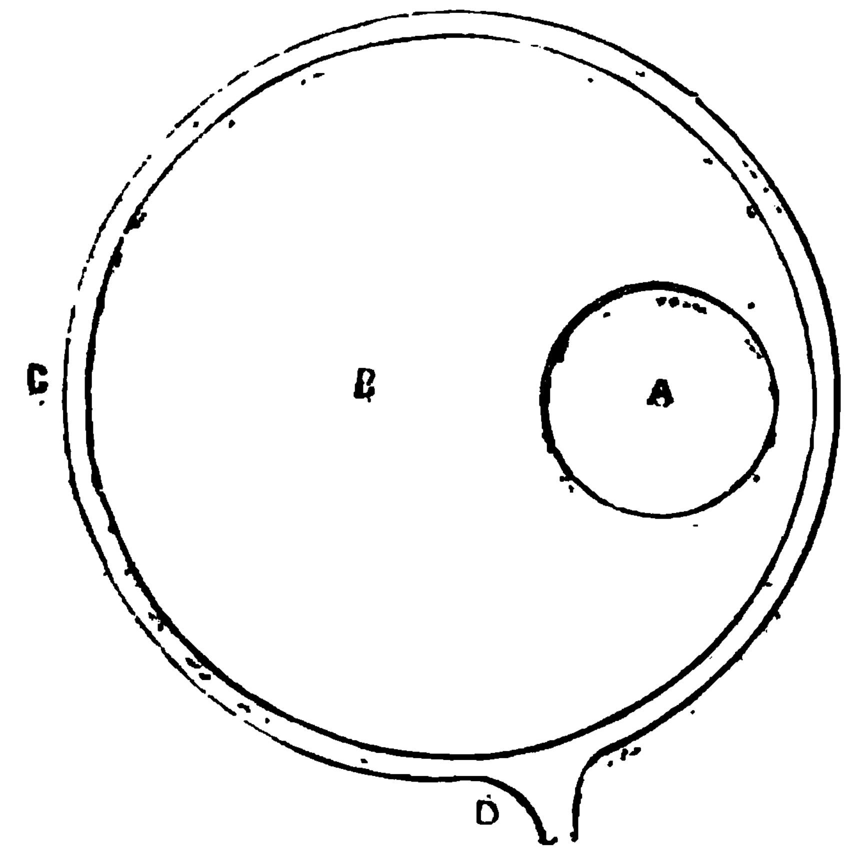


Fig. 2.

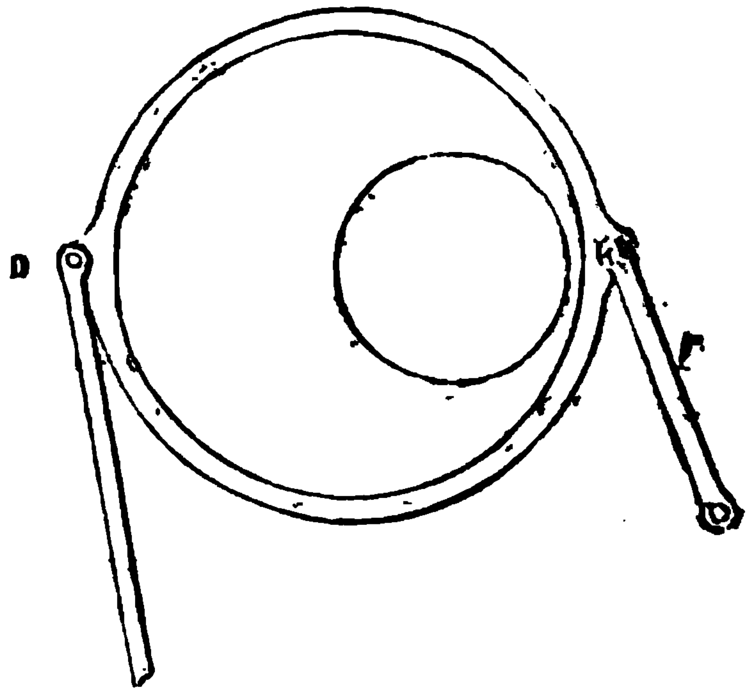


Fig. 3.

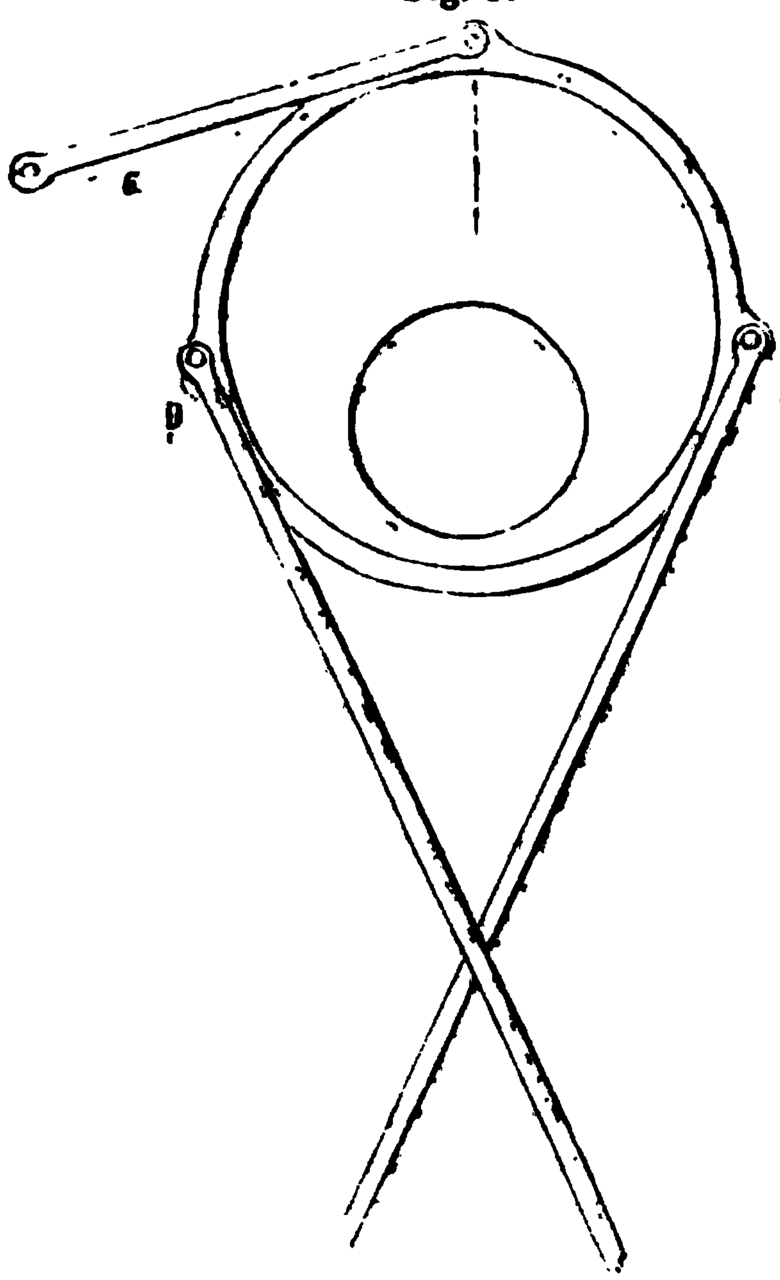
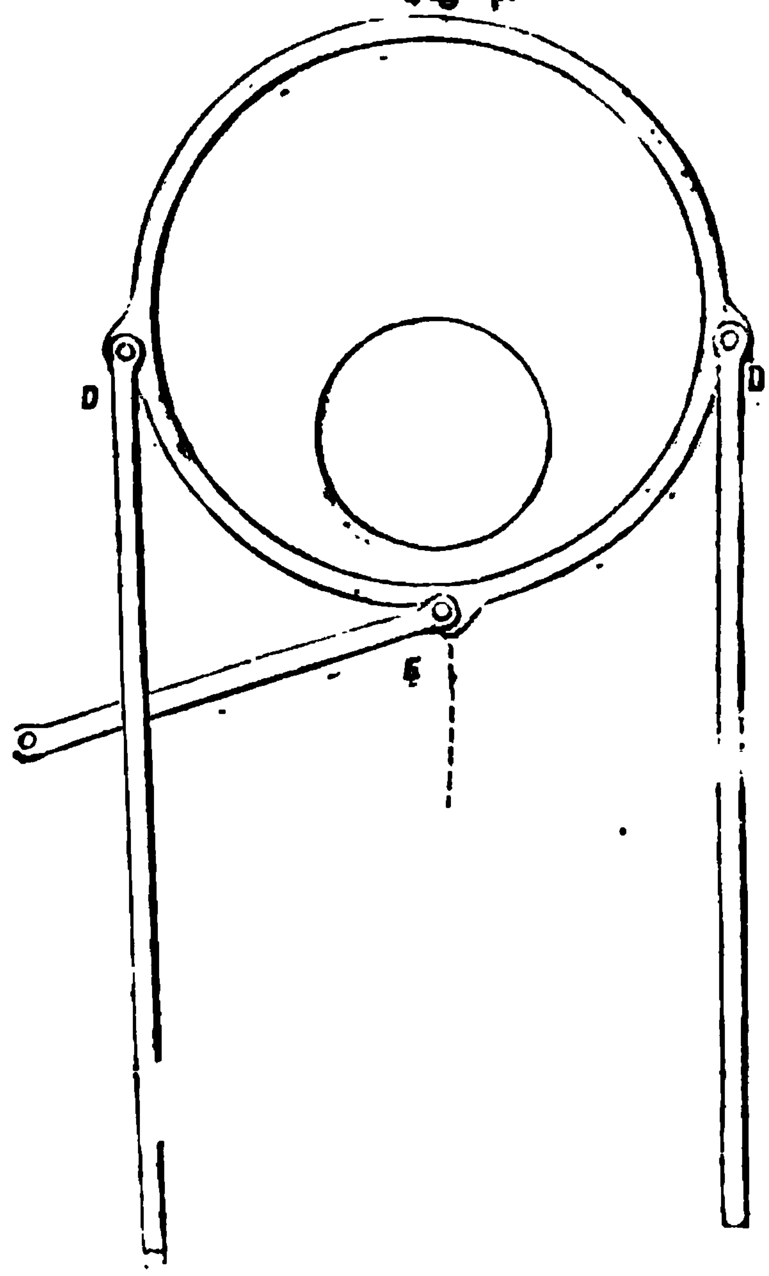


Fig. 4.



The motion produced at the connecting-

rod joint is peculiar, and is best shown in a model; but the accompanying sectional outlines may be sufficient to illustrate the principle. Each sketch is set out to produce an equal length of stroke.

Fig. 1 is the common eccentric; A being the shaft; B the block or disc; C the ring; and D the connecting-rod.

Fig. 2 is the method described, carried out for one air-pump; D being the connecting-rod, and E the holding-rod, having its vibration represented by dotted lines.

Figs. 3 and 4 are arrangements for working two air-pumps; in which the eccentric must be somewhat enlarged, as shown, or the connecting-rod joints may be projected from the ring.

I am, Sir, your obedient servant,

THOMAS HOWARD.

King and Queen Iron-works, Rotherhithe, March 27, 1852.

THE INVENTION OF WOOD-CUTTING MACHINERY.—SIR SAMUEL BENTHAM.—MR. BRUNEL.

Professor Willis, in an instructive Lecture at the Society of Arts, 28th January last, when speaking of the advances made in mechanism at the end of the last century, observed, "Foremost amongst the ingenious persons who carried on this great movement must be recorded Brigadier-general Sir Samuel Bentham." In subsequent parts of the lecture many of the General's inventions are particularized, and they are stated to have led to his appointment as Inspector-general of Naval Works. The Professor further said that in the year 1797, "the introduction of machinery for the preparation of blocks and other works in wood at Portsmouth takes its origin. In 1802, the General received a most powerful and efficient auxiliary in the person of Mr. Brunel . . . . . At this distance of time it would be impossible to discover the exact shares of merit and invention that belong to Brunel, Bentham, and Maudslay in this great work." The Professor in other parts of his lecture regrets that so little is found in British publications as to the origin of machines. These observations, together with the impression so generally entertained that the nation is indebted to Brunel for the whole of the machinery in Portsmouth-yard, as well as for the judicious arrangement of the several engines in the Wood-mills, has led to the selection, in respect to that manufactory, of as many particulars as can be now collected from documents undoubtedly authentic. Those herein made use of, consist, previously to the year 1791, of private correspondence only; subsequently to that time, the authorities which have been had recourse to are Bentham's patents of 1791 and 1793, official proposals and correspondence, the Act of Parliament 52nd of George III. (20th April, 1812), for making compensation to Jeremy Bentham, &c., Minutes of Evidence given to the Arbitrators chosen as that Act directs; also a few extracts from Bentham's journal, and, in still less number, recollections of the writer of these lines, as will be particularly mentioned on each occasion of their recurrence. The whole of the written documents can be referred to in the originals at any time. It has been with much regret that with a view to the giving a consecutive narrative some documents are repeated which have already appeared in the *Mechanics' Magazine*, Nos. 1323, 1367, 1427, 1487.

Books considered as authorities, such as the "Edinburgh Encyclopædia," "Ure's Dictionary," "Fincham's History of Naval Architecture," &c., attribute the whole of the machinery in the Wood-mills, Portsmouth, to Brunel; but the authors of these works could hardly have had access to authentic documents; not even Mr. Fincham—for only a very few on the subject in question have ever been recorded in the Dock-yard books. The statements of those authors it may therefore be concluded were grounded merely on popular report, though the engravings of machines might have been taken accurately from the machines themselves, or from drawings of them.

The documents herein referred to prove the following facts:

That all the operations preparatory to the shaping of blocks were from the first, and still continue to be, performed by machines of Bentham's invention—not Brunel's—and that several of these machines were the *identical* ones which had been exhibited at work by Bentham at his residence in Queen-square Place, so early as the year 1794—

That Brunel's machines were confined to some few only of the operations requisite for the shaping and finishing of

blocks; and also that in these instances the means of performing the requisite operation were rarely other than those specified in Bentham's patents—adapted, however, with skill by Brunel to the purpose of shaping and otherwise perfecting the blocks—

That the pleasing and convenient arrangement of the block-machinery, whereby a regular sequence of operations is obtained, was devised by Bentham, contrived in his office, under his immediate superintendence, and principally by Mr. Goodrich, the mechanist in that office—

That the machines for making what are denominated block-makers' wares were all of them Bentham's—

That all the machines and engines applicable to *general* purposes were Bentham's.

In proceeding to give detailed proofs of these assertions, some ingenious contrivances of Bentham's between the ages of fifteen and twenty-two, may be passed over, to come to his first important piece of mechanism, contrived more than eighty years ago—*a planing-machine.*

By the advice of Lord Howe, in the year 1779, Bentham undertook a tour for examining into naval concerns in the north of Europe, and when in the Ural Mountains, seeing reason to extend his travels far into Siberia, he had occasion for a carriage suitable for so long a journey, an amphibious one of his invention was made for him at Nijni Taghil, a mining and manufacturing establishment of Count Demidoff's. During Bentham's stay there, he invented a machine for *planing wood*, and for giving it, according to the cutters used, a variety of forms—amongst others that of mouldings. He communicated his invention to his friend, Sir James Harris, the English Ambassador at St. Petersburgh, expressing his desire to profit by it in Russia. Sir James advised him to reserve his machine for the benefit of "Old England." At a subsequent period Bentham was induced to accept military service in Russia; Prince Potemkin giving him from the first the rank of lieutenant-colonel, placing him under his Highness's immediate and exclusive orders and control, and stationing Bentham's battalion at Cricheft, that he might train some of the men as shipbuilders, others in navigation. The Prince possessed in that part of the empire domains which exceeded in extent many an English county, and many manufactories carried on at Dubrovna, near Cricheft. They had been under the direction of a colonel in the army, whose management Bentham perceived to be ruinous; this induced him to offer the taking it gratuitously on himself. His Highness failed not to accept the liberal proposal with grateful thanks. These manufactories were on a very extensive scale for the fabrication of cordage, glass, various metals, works in wood, a pottery, &c.; during Bentham's superintendence of them, he made considerable progress in the farther invention of machinery, though no written particulars of specific engines have been found—nothing more than notes and rough sketches of the means by which such and such results might be obtained.

It may well be asked in what way so young a man had become competent to this vast undertaking? It was from a combination of scientific with practical education; for after having received classical instruction at Westminster-school, his decided predilection for naval affairs induced the binding him to the master-shipwright of Woolwich Dock-yard, with whom he served a regular apprenticeship of seven years, receiving at the same time with experience in manipulation, all the scientific instruction which could be obtained from the best professors of the day. He afterwards spent a year and a half in studying the practice of the several other Royal dock-yards, and some time as a volunteer and captain's guest on board a first-rate ship in Keppel's fleet. His subsequent extensive travels in Europe and Siberia gave him great knowledge in a vast variety of manufacturing concerns.

Having obtained leave of absence, he came to England early in 1791: his turn for mechanical works led him, in 1791, to visit most of the great manufactories in England. He found much machinery in use for the spinning of cotton, but for the working in wood none save some turning lathes, some circular and reciprocating saws, and some boring tools used by the Messrs. Taylors for making blocks. Shortly afterwards it happened that his brother, Jeremy Bentham, was engaged by Government to undertake the introduction of industrial prisons,

Samuel Bentham, with a view to render convict labour profitable, perfected a variety of machines of his invention for working stone, metals, cork, &c.; and more; particularly those for working wood. Patents were taken out for them; dated Nov. 26, 1791, and April 3, 1793. By these patents it will be seen that the several operations which have place in the working materials of various kinds were *classed* according to the nature of the *operations themselves*, instead of being left to the customary artificial and partial arrangement according to particular trades or handicrafts, and the machines and engines requisite for the performance of these several operations were described. By this scientific classification, joined to the description of machines and engines, these patents indicate the modes by which nearly all the operations in working wood have been subsequently performed. These patents are given in volumes v. and x. of the "Repertory of Arts and Manufactures;" they seem to have been altogether unknown to the many who have given to Brunel inventions that are clearly described in the specifications of these patents—they do not admit of abbreviation, therefore persons interested in the subject of machinery are referred to the specifications themselves.

In the intention of using Samuel Bentham's machinery in the industrial prison, and as Jeremy Bentham's residence in Queen-square Place, Westminster, afforded capacious outhouses, they, together with the whole house, No. 19, York-street, were converted into a manufactory of Samuel's machines, where many were made of full size, and put to work, the force of man being there employed to give them motion. They were equally suitable for being worked by a steam engine, or any other force, animate or inanimate. Amongst the machines there perfected for working wood, were those for the general operations of planing, rebating, mortising, sawing both coarse and fine work in curved, winding, and transverse directions, shaping wood in complicated forms, &c.; farther, in the way of example, an apparatus was completed by which all the parts were prepared of a highly finished window-sash, and another for preparing all the parts of the more complicated article, an ornamented carriage wheel, so that in neither instance did anything more remain to be done by hand than the putting the several component parts together. These machines were inspected by a great variety of persons; and in the year 1794 by several members of His Majesty's then Administration, they having expressed their wish to see them at work. His Majesty's Ministers were in consequence so well assured that great *national advantage* would result from the use of Bentham's system of machinery which they had visited repeatedly, that it became a subject of public notice in the House of Commons, especially by Lord Viscount Melville, then the Right Hon. Secretary Dundas.

The naval part of the administration, after frequent communications with Bentham, authorized him early in 1795, and that under the signatures of every member of the Board of Admiralty, to visit the Royal Dock-yards, for the purpose (amonst others) of suggesting the cases in which his machinery worked by steam engines might be advantageously introduced. His views of improvements were highly appreciated; and, in consequence, prospects were laid before him which, together with an ardent desire to be useful at home, induced him to relinquish the honours and pecuniary advantages that awaited him in Russia, and thenceforward to devote himself to his own country in the civil service of the Navy.

But it is not always the superior authority that governs: the projected innovation of working wood by his machinery was opposed by the subordinate Board; it was represented that steam engines would set fire to dock-yards, machinery would occasion risings of artificers, and so forth. Lord Spencer considered it prudent, therefore, to postpone the introduction of such improvements; but as Bentham was building experimental vessels at Redbridge, his Lordship advised and sanctioned the erection of a steam engine there, to work Bentham's machines. Some of those from Queen-square Place were accordingly sent to Portsmouth, on their way to Redbridge; but the steam engine not having been completed till most of the vessels were afloat, the machines in question were placed in store in Portsmouth-yard.

It was not till 1797 that the Admiralty ventured to authorize the introduction of

a steam engine at Portsmouth—even then, under the pretence of its being necessary for pumping the new docks, but at the same time with the professed intention of introducing Bentham's machinery.

After the lapse of more than half a century, proof of the introduction of this or that particular machine is difficult; but Bentham's official letter to the Admiralty, 21st December, 1797, particularizes the operations it would *at first* be most advantageous to execute by his machinery.

That document commences by a reference to their Lordships' letter of 22nd April, 1795, stating that he had "lost no time in considering the means of enabling inanimate force to perform some of the most important of the preparatory operations subservient to naval works." This official communication continues thus:

"With regard to the working in wood, the operations to which machinery appears applicable to the greatest advantage are as follows:

"1st. By means of a reciprocating motion—sawing in general, particularly straight work, such as siding of timber, slitting deals; cutting, quartering, and straight planks of all kinds.

"2nd. By means of a rotary motion—edging, tongueing, and grooving, rebating, and cross-cutting into lengths deals of all sorts for joiners' and house-capenters' use.

"Tongueing and grooving of piles for dam-work.

"Converting slabs and offal timber into treenails, and manufacturing them on a new principle in such manner as to enable them to contribute much more to the strength of a ship than treenails can do as they are made at present.

"These, among various other instances, had occurred to me as giving occasion in his Majesty's Dock-yards for the substitution of the invariable accuracy of machinery to the uncertain dexterity of more expensive manual labour," &c., &c.

This proposal was, without hesitation, adopted; and several of these machines were by degrees put to work. It appears, by a note added to the rough copy of the proposal, that *all* of them, with the exception of that for tongueing and grooving piles, were tried. At first, the force employed was that of man, whilst waiting for the erection of the steam engine.

Some of these machines Jeremy Bentham received payment for at a valuation much below their real cost, exclusively of all preparatory expense of drawings, models, and other contingencies; for others, he never received a sixpence of remuneration; in no instance, any compensation for the extra cost of constructing engines, at that time so novel. The bills sent in were made out in the name of John Lloyd (who had for many years worked exclusively for Samuel Bentham, in Queen-square Place), and they were certified by the mechanist in the Inspector-general's office. The first of these bills was dated 28th October, 1799; it specified "an apparatus for sawing," &c., &c.; also "the freight of various articles of machinery delivered in Portsmouth Dock-yard." Lloyd's second bill was not sent in till several years after the machines charged in it had been in actual use in the Dock-yards of Portsmouth and Plymouth; namely, with Bentham's letter to the Admiralty, 30th July, 1805. This letter said that the charge was for "several articles of machinery sent, some to Portsmouth, some to Plymouth, which having been long before made according to my plans, he (Lloyd) happened to have by him; and some of these machines, particularly the circular saws, I had the satisfaction of witnessing their Lordships' approval of at their late visitation (in 1802) of Portsmouth and Plymouth yards; but as some of these articles were of trifling value, no demand has as yet been made for payment of these." This bill specified sundry lathes and sawing machines; an oaken saw-frame complete; a frame for cutting tenons; a frame calculated for boring, turning, and sawing; a boring-machine, with boring bits and squaring tools; as also various other machines of different sizes and for different works.

Saw-mills having been long frequent in foreign countries, and turning lathes at home, it might seem that the above bills indicate no particular invention; but Bentham's patents prove clearly that his inventive genius had enabled saws, and turning lathes, and boring tools, &c., by the simple turning of an axis, to perform accurately and at pleasure *all*, it might be said, of the operations in cutting and shaping wood to which machinery has

been since applied in the Portsmouth Wood-mills, the block machinery included. It was Bentham who first devised and first described means the same as those now in use to bring wood to parallel surfaces or to angular ones—to cut it to any desired depth at any given angle; to curves, circles, and elliptical forms—to bevels, windings, taperings, as also to complicated shapes, either on the surface of the desired article or in the interior of it: and for the performance of these various works, lathes themselves, for example, were constructed by him in a novel manner; and the cutting tools were many of them his own invention, as were the several efficient means of supporting the material, steadying it, and clearing away shavings and abraded matter, &c., &c., on which the efficiency of engines so much depends.

Some of the Bentham machines were put to work in Portsmouth-yard before the end of the last century—in that of Plymouth, early in the present one; through the buildings intended for them not being yet erected, the engines could not be systematically arranged, nor full advantage be derived from their use. It was in this state of imperfect efficiency that they were seen at work by the First Lord and other Lords of the Admiralty, during their visitation of the naval arsenals in 1802, as recorded in their "Minutes of Proceedings," page 45. The improved reciprocating and circular saws, and their subservient apparatus, as also the engines for making and inserting coques, particularly attracted their Lordships' attention.

In that same year, 1802, Mr. Brunel, bringing drawings of a machine for shaping block-shells, presented himself to Bentham at his private residence. Bentham's attention was at that time, by Lord St. Vincent's command, almost exclusively directed to the introducing a better mode of management in respect to timber. It was well known at the Admiralty that the making of improved blocks was one of the first uses to which his machinery was to be put, so that he was well satisfied to find in Mr. Brunel a very skilful and otherwise competent person to arrange the details of a suitable apparatus for that purpose, and to take an interest in this particular branch of business. After much inquiry respecting Brunel and his works, and his connections in this country, Bentham mentioned the circumstances to Lord St. Vincent, and, with his lordship's sanction, recommended Brunel to propose his machine in a letter to the Secretary of the Admiralty: such a letter was accordingly prepared, sent to Bentham with a request for his "approval and correction" of it, then forwarded to the Admiralty. It was shortly afterwards referred officially to Bentham for his observations on the proposal, and on April 15th he recommended the adoption of the shaping machines, "as a *part* of the system of machinery to be worked by the steam engine already provided, so as to combine with the machinery *already provided*, or which it may seem advisable to erect in that dock-yard," thus referring officially to Bentham's own machines already ordered, and many of them in actual use in Portsmouth-yard at that very time.

Now as to Brunel's and Bentham's machines respectively: Brunel's *drawing* was at that time confined to the shaping of a block-shell; Bentham's *machines, already in the Dock-yard in a working state*, were competent to the performance of all the previous costly operations requisite in cutting and cross-cutting, and taking off angles from the wood intended for a block-shell, so as to prepare it for the shaping machine: some of those used in the block manufactory were the *identical* machines brought from Queen-square Place; those, and similar ones made in duplicates and triplicates, and some on an enlarged scale, were from the first, and still continue to be, the only ones in use in the preparing for blocks, as also for general purposes of the yard.

Brunel's machinery was ordered by the Admiralty, but subject to Bentham's approval of each engine that might be necessary, and under orders that he (Brunel) should concert with the mechanist in Bentham's office, in order to combine the requisite additional machines with those of his invention. Bentham considering Mr. Henry Maudslay particularly skilful in mechanism, to him was confided the making whatever additional apparatus might be necessary for the making of blocks.

From the time when Bentham saw reason to patronize Brunel, he was frequently at the Inspector-general's office, in consultation with the mechanist, with

Mr. Burr, with Bentham himself, besides being often at his residence, Queen-square Place. The mechanist, Mr. Simon Goodrich, had, during Mr. Rehe's illness, supplied his place at that office; and on his demise Goodrich, though young, appearing to Bentham to be possessed of much mechanical talent, and the salary assigned to the mechanist being unworthy of acceptance by any man already distinguished in the profession, he recommended Goodrich as the successor of Mr. Rehe; but this was on the private condition that Goodrich should employ a considerable portion of this scanty salary in visiting manufactories for self-improvement. He did so, provided with introductions to Bentham's private friends —and with all the success expected and desired. His having been chosen as Bentham's *locum tenens* when sent to Russia, is of itself proof of Goodrich's general skill and talent. The Mr. Burr above mentioned had been a Dock-yard man, but was engaged to make models and as a general workman by Bentham, when first he executed his machinery, and continued in his employment until the institution of the office of Inspector-general of Naval Works: at that time, by Lord Spencer's desire, Burr was appointed a draughtsman in that office for the sake of retaining him to be in readiness for the introduction of Bentham's machinery. In May, 1802, he was sent for that purpose to Plymouth-yard, and, as stated in a letter from the mechanist, was "assiduously employed in forwarding the circular saw-benches. The saws, &c., sent from town arrived here yesterday. The foot-saw is fitted up in the joiners' shop, the master of which seemed well pleased with it, and of his own accord immediately suggested an application of it to the cutting the tenons of the rails of ships'-tables." The mechanist, in the same communication, speaks of "long-cutting and cross-cutting machinery of Bentham," of the "reciprocating slitting saw-frame in No. 19" (part, as before mentioned, of Jeremy Bentham's premises), of the "tenanting saw," and of other machines of Bentham that it would be desirable to have at Plymouth. It must be observed that this was before Brunel's machine was even *ordered* by the Admiralty, none of the parts of which arrived at Portsmouth till the 5th April of the following year, 1803.

Bentham intended to have given motion by hydraulic power to his machines at Plymouth, but was prevented doing so by a failure of the Plymouth Dock Water Company to furnish the supply stipulated for by their Act of Parliament, so that even the intended reservoir could not be decided on, nor many of the Bentham engines already in the yard be put to use. The remains of many of them were long afterwards surveyed by Mr. Mitchell, but what finally became of them is not known.

Mr. Mitchell was the late engineer at Sheerness Dockyard; "he was first engaged at Portsmouth in January, 1803; he then saw in that dockyard a considerable quantity and variety of the Bentham machines for working wood. It appeared to him that the "Saw-mills had been intended for Plymouth, as the work had been prepared for some years, and some parts sent to Plymouth; there were therefore some parts sent back from Plymouth, and some parts from Queen-square Place, and some few wanting which had to be prepared, all of which had to be made good, which occasioned some delay. These saw-mills were more especially under my superintendence, having had considerable experience in that line at the Leith Saw-mills. There was one small saw-mill which came with some other machinery from Queen-square Place for cutting veneers; the number of cuts it made in an inch is so incredible, that I can only say, that neither the saws, the cut, or the veneer, were more than the thickness of common writing-paper; this was placed in the floor over the engines, but was afterwards removed to some other part which I cannot call to mind."*

On the 2nd January, 1803, Bentham sent to the Navy-office drawings showing the requisite apparatus for giving motion to machinery at Portsmouth; that is, between three and four months before the arrival there of any of Brunel's.

On the 1st of June, 1803, Bentham proposed to the Admiralty the setting up *forthwith* in Portsmouth-yard various of his engines as already sanctioned by their Lordships, to be worked by the steam engine, saying in his official letter, that "Independently of various other

* Letter from Mr. Mitchell, dated 26th February 1852.

uses to which they are applicable, they are, as it were, necessary for the cutting out the wood to the proper scantlings and lengths for shells of blocks, and therefore had it not been that Mr. Brunel was apprized of my intention of proposing the introduction of these engines for *general purposes*, he would have required some such engines as part of the machinery requisite for his particular branch of business." Positive proof is thus afforded that the many money-saving operations preparatory to the shaping the shells of blocks were from the first executed by machines of Bentham's invention, not of Brunel's.

The erection of Bentham's machines being ordered, it soon became necessary to appoint some person to see to the care and management of them, as also of that peculiarly adapted to the shaping and finishing of blocks; Brunel was desirous that that person should be Mr. Burr, so that Bentham, on the 11th June, 1803, officially proposed him for this office in the following terms:—

"As Mr. Brunel's apparatus for making blocks, however important, will form a *part only* of the machinery which is, or will be erected in that (Portsmouth) Dockyard for working wood, I see no reason why the same person should not be charged with the whole of this machinery, including all such engines constructed on the principles of those which I had long ago put in practice, as well as those of Mr. Brunel's invention;" and therefore, according to Mr. Brunel's request, recommended the appointment of "James Burr, who holds the situation of draughtsman in my office . . . He certainly is the person I look upon as most particularly suited to this duty, he having been originally brought up in a dockyard, and from his having been employed by me in the erection of such machinery from the time when I first applied myself to the invention of it previously to my being engaged in his Majesty's service, and, in fact, was placed in his present situation, and has been retained in it, with a view to his being recommended for this duty as soon as there should be occasion for it."

Mr. Burr was accordingly sent to Portsmouth on this duty. Mr. Brunel having requested that William Barlow, "a workman of superior dexterity and skill," should be employed exclusively in the block-making machinery; Bentham recommended that this request should be complied with also. William Barlow was then at Partsmouth, as Maudslay's foreman.

The above-mentioned Bentham engines having been set up, and considerable progress having been made in the erection of those peculiarly adapted to perform the several operations requisite in completing blocks, it appears that Bentham had desired his machinist to report what part of the block-making machinery could be applied to *general* purposes, when the following letter was addressed to Bentham by Mr. Goodrich:

"Portsmouth Dock-yard, 12th Nov., 1804.

"Sir,—*None* of the existing machinery more immediately belonging to the mortising, shaping, and boring of the shells of blocks can be well applied to any other purpose as far as appears at present.

"The circular saws, and up-and-down saws (all of them Bentham's), *can* be applied to *general* purposes, and others may be introduced for cutting, as follows:—

"Oak hammock racks, oak tracing battens, ledges, fir and oak square, grating battens, edging deck deals, edging and rebating deals for bulk-heads and platforms, converting oak board for ladders, cutting stanchions and pillars of fir and oak, cutting out and rebating stanchions and cants for bulk-heads, slitting deals, and cutting feather-edged boards."

The dimensions of these articles were severally noted; though here it seems only necessary to state generally that they were from 8 inches square down to 2 inches and to 1¾ inches, and in broad work, from 1 inch to 1¼ inches thick.

The letter continues thus,—

"The frames for small deal tables may be cut out and morticed by machinery upon the General's plan (Gen. Bentham's). Mr. Burr thinks there is the principal part of an apparatus at No. 19, that would answer this purpose.

"Pillars may be turned which are at present turned by contract; likewise table legs, and spokes for steering wheels.

"Wanted for block-makers wares—machinery for boring of wooden pumps. The other articles of block-makers wares consist principally of such things as can be cut out by circular saws and turned in a lathe.

"Planing-machines wanted for deck deals, whole deals, and slit deals—most probably circular, or rotative planes will be

the properest for this kind of work. There is a circular plane at Queen-square Place that has never been tried, it would be very advisable to have this sent down here and put to work immediately for experiment.

"Most of the foregoing work, when machines are by degrees brought to answer these purposes, may come under the management of the master block-maker,* within the compass of the building now erected, or which may be erected over the reservoir. The circular saw for edging, rebating, and cutting out into small scantlings is now ready; also the two reciprocating saws for cutting baulk and plank into scantlings.

"As it is proposed to have another reciprocating saw for converting for block-making, and more circular saws, they may jointly, with the existing reciprocating saws and circular saws, be made to cut out most of the work before-mentioned.

"A saw-frame will be particularly wanted for slitting deals, and cutting feather-edged boards. There is one at No. 19, that will answer particularly well for this purpose after having been lengthened, which alteration can best be done here under Burr's direction; I would therefore recommend this frame to be sent down here along with the circular plane and small mortising-engine above-mentioned."

Mr. Goodrich goes on to state projects for cutting mast timber by machinery, which it would seem that Bentham had in contemplation at the time, but the plans for which were not perfected till the year 1812, when an apparatus for this purpose was included in the machinery proposed by him for Sheerness Dockyard.

The mechanist's letter is subscribed,

"I am, Sir,

"Your very obedient Servant,

"SIMON GOODRICH.

"Inspector-general, Admiralty, London."

The above communication seems in itself sufficient proof that great part of the machinery comprised in that for block-making was from the first, and still continues to be of Bentham's invention, not of Brunel's; and what is of importance in an enlarged consideration of machinery, that Brunel's engines erected in Portsmouth-yard, were none of them applicable to *general* purposes, whilst those of Bentham were then used there, as it must be added they still continue to be for working wood of many descriptions, and for a great variety of applications in civil and in naval constructions; as well as in engineering works requiring wood as a material.

Bentham has said himself in his official "Statement of Services," 1813, "I was satisfied that Mr. Brunel had skill enough to have contrived machinery to have answered the same purposes had he not found mine ready to his hands." So the present statement is not intended, nor can it be construed, as derogating from Brunel's inventive powers, although his faculties were directed otherwise than those of Bentham. Brunel confined himself to the production of some one given effect; Bentham, on all occasions, generalised and classed: his classification of operations in working materials has been considered of sufficient importance to be distinguished by italics in the printed copy of Professor Willis's lecture. It is there said of Bentham (as above mentioned), that, "rejecting the common classification of works according to the *trades* or *handicrafts* for which they are used, he *classed the several operations that have place in the working of materials of every description according to the nature of the operations themselves.*" It is obvious that great facility is thence afforded in suiting machinery to the production of any given effect, and so to have done an essential service to inventors of engines generally.

When Bentham invented his plane, in 1783, there was not a single example of any analogous engine. From 1791 to 1793, the dates of his patents, he had nothing before him as a guide in working wood, save the direct and somewhat rude application of borers and circular saws by the Taylors; he had no skilled workman to give a hint, or to indicate the degree of strength requisite in this or that part of an engine, and he had himself to teach his workmen; he had no master engine-maker to aid by his experience; for Mr. Rehe furnished nothing more than what, in fact, were rough materials,—such as catgut, hooks for attaching it, toothed wheels, iron axes, and similar articles. Bentham himself made the sketches from which more finished drawings and models were taken; worked when necessary with his own hands; had every engine made under his own eye, at his home. How differently in these respects was

* Mr. Burr was so called familiarly in the Dockyard at that time.

Brunel circumstanced! He had Bentham's patents before him—patents which specify nearly every variety of movement and supposed requisite for the cutting and giving shape by machinery to materials; Brunel, from almost the first time he presented himself in Queen-square Place, had opportunity of seeing the Bentham machinery there, and afterwards at Portsmouth. Brunel had, from that time, very frequent intercourse with Mr. Goodrich, with Mr. Burr, with Bentham himself, both at his office and at his own house. Brunel's machines were never sanctioned till drawings of them had been well considered and approved by Bentham; during such examination can it be doubted that he suggested many an improvement? Those machines were made by Henry Maudslay, after frequent consultation with Bentham, and examination of these often whilst in progress of manufacture. Bentham, Goodrich, Burr—all of them—discussed the suitableness for its destined work of every particular engine, each of them indicating means by which it might be more or less improved.*

How can it have come to pass that, until the lecture of Professor Willis, the invention of machinery for working wood has been withheld from Bentham, and bestowed so liberally on Brunel? It arose from Bentham's magnanimity;—*self* was with him a very inferior consideration to that of national advantage: he had at heart the introduction of machinery as a source of national wealth: he wished to accomplish this innovation, and did accomplish it, without injury to either employer or employed. It had so happened that leading ministers of Government had monopolized his talents and his services; it was consequently in naval arsenals that he had to introduce machinery, but under difficulties of many kinds, especially that of opposition to its use, lest it should cause strikes of artificers. He soon, on acquaintance with Brunel, perceived that his manner was peculiarly ingratiating, that he possessed no small share of that French tact which finds means of dissipating fears and of doing away objections; these qualities, superadded to real talent, pointed out the possessor of them as the kind of man most likely to render popular the introduction of wood-working engines at Portsmouth. To Brunel, therefore, from the first, and to the last, he afforded every encouragement in his power—every stimulus to exertion. The machines that were *notoriously* Bentham's, he spoke of as being so in official correspondence, but always called other parts of the machinery used in making blocks Brunel's, although most of them were nothing more than the adaptation of his own contrivances to the specific use of shaping and finishing blocks; and this although Brunel's machine went no farther than the shaping the shells of them when first its adoption was recommended. Bentham had been long struggling, too, for the obtainment in Royal arsenals of the same kind of management as that observable in private manufactories, and without which, he affirmed, no manufactory, public or private, can prosper. He had already been for years endeavouring to introduce this sanatory reform; the superiors in naval administration seconded him, but all inferior authorities were adverse; but as he was little interfered with as to the machinery at Portsmouth, he now determined to prove the eligibility of some of the measures he proposed, by introducing them in the manufactories of wood and metal there, and he conceived that Brunel in this respect also might render useful service; to initiate him in this kind of management, Bentham introduced him early in 1803 to the Messrs. Strutt, of Belper and Derby, and at their establishments pointed out the practice he wished to be introduced at Portsmouth. This may seem a useless digression from the machinery for making blocks; yet it is far otherwise, since no inconsiderable part of Brunel's remuneration arose from the good management Bentham introduced in the Wood and Metal-mills.

Mention must now be made of what was to Bentham amongst the most painful occurrences of the seventeen years he was in the public service—Brunel's disposition to encourage the impression on visitors that all the machinery in the Wood-mills was of his own invention. This was, to a certain extent, excusable at the time, for he had then a reputation to create, and an increasing family to provide

* From personal knowledge, supported by Bentham's signature of approval.

for. At a late period, however, he failed not to express in writing his gratitude for favours received from Bentham in 1803; yet so it was that from the time the Wood-mills began to attract attention, Brunel was averse from enlightening the public as to the real contrivers of the machinery therein—so much so, indeed, that he even ventured May 30, 1805, to forbid Burr, by written note, "to answer any queries respecting blocks, or block-making, without his having previously communicated them to him;" and this, too, after the time when the Wood-mills and Burr were placed under the individual management of Bentham,—as was indeed Brunel himself. Brunel being for years almost constantly on the spot, without any immediate need for personal occupation, had, of course, frequent opportunities of calling the attention of visitors to the machines of his own arrangement, without pointing out those of the block-machinery which had originated with Bentham, or that were specified in his patent, or that the general arrangement in the mills had been made in the Inspector-general's office; at the same time it was very natural to pass over without calling attention to the money-saving operations that Bentham's machines performed. Whilst Brunel had thus leisure and opportunity for obtaining credit to himself, Burr's active and onerous duties debarred him from taking the place of a showman, or vindicating Bentham's claims.

Professor Willis, in speaking of the block-machinery at Portsmouth, observes, that "At this distance of time it would be impossible to discover the exact shares of merit and invention that belong to Brunel, Bentham, and Maudslay, in this great work. To the first, however, we may assign the merit of completing and organising a system of machine-tools, so connected in series that each in turn should take up the work from a previous one, and carry it on another step towards completion, so that the attendant should merely carry away the work delivered from one machine and place it in the next, finally receiving it complete from the last."

Had the Professor been aware of Bentham's official correspondence, doubtless the systematic arrangement of the block-machinery would have been ascribed to him. In his very first communication to the Admiralty on the subject of blocks, April 15, 1802, it was recommended and was ordered accordingly, that Mr. Brunel should "concert with the mechanist in *my office* respecting the best mode of fixing up the different engines and apparatus which may be requisite for the manufacture of the different sorts and sizes of blocks;" and on the 2nd January, 1803, it was Bentham who sent to the Navy Board drawings from which they were to have made the apparatus for giving motion to machinery. By his official "Statement of Services," it clearly appears that the systematic arrangement of those engines was due to Bentham; the statement on this particular runs thus:—"As I had considered it highly conducive to the hastening the introduction of a general system of machinery that public opinion should obtain in its favour, and that this was likely to be more surely effected by a display of well-arranged machines for the accomplishment of one particular object, I determined, as the machines which it might be expedient to employ exclusively for block-making admitted of a pleasing arrangement, that the whole should be placed to the best advantage in point of appearance as well as use; postponing the introduction of, and even removing such parts of the system of machinery mentioned in articles 2 and 3 (2, saw-mills; 3, facts of a general system of machinery for working in wood), as might stand in the way of the block-machinery, reserving only those which were requisite for this business; not doubting but that Mr. Brunel, being then almost constantly on the spot, and interested as he was to bring the advantages of this particular machinery to full view, would engage public opinion in favour of the introduction of machinery in general. Indeed, this effect, as the machinery came into use, he did not fail in producing, insomuch that his representation of the advantages of machinery in general might well occasion the multitude who visited the Wood-mills to ascribe to him the introduction into the Dockyard of the machinery of every kind that had been introduced. But however my credit may have been affected in consequence of such an opinion, I feel no regret in reflecting on any part of my conduct in this transaction."

It cannot be supposed that Bentham contrived every detail—that was Goodrich's particular duty; and Brunel had his share in the arrangement, sometimes advantageously, at others introducing wheels that would not work, as appears from a pencil sketch now laying on the table. On many occasions Bentham's skill was only exercised in the way of suggestion, or desire that this or that might be effected—for instance, by Brunel's arrangements, riveting in the coques was done by hand irregularly, and seldom perfectly. Bentham desired that a little tilt-hammer should be made to perform this operation, and pointed out where a band might be placed to produce the requisite motion.*

The three manufacturing establishments in Portsmouth-yard proposed by Bentham, and at their outset without any special authority conducted according to his directions, he had, early in the year 1805, brought on to a state requiring a regular establishment, and to such regularity as to have become capable of being placed under the Dock-yard officers; having proposed this to the Admiralty, they referred it to the Navy Board. That Board reported that neither the members of it, nor any of the persons under them, were competent to the "superintendence of works of so great a magnitude, consequently, the responsibility attaching to the due performance thereof," and that they saw "no alternative" but that of placing them under Bentham's individual management. The Wood-mills, the Metal-mills, and the millwrights were accordingly, from the placed by Admiralty order as entirely under his management and control, as though they had been private concerns on his own account.

He had barely had time to organize these manufactories, when he was suddenly sent away on a mission to Russia. His absence for two years and some months afforded further opportunity for the impression to gain ground, that the machines in the Wood-mills at least were all of them of Brunel's invention. He continued almost constantly there; even the Admiralty in a letter to Bentham's *locum tenens*, spoke of *Brunel's* circular saws; to which Goodrich replied that they were *not* Brunel's; "but Genera Bentham's improved circular saws."

Brunel's remuneration, in conformity with Bentham's recommendation, April 30, 1803, had been ordered to be the savings for a year produced by his machines. That for block-making was not completed till after Bentham's return home, 1807. Brunel, in his application for remuneration, stated those savings to have amounted for the year to 21,174*l.* 12*s* 10*d.* Mr. Hynam Rogers in calculating them on the part of the Navy Board, according to the contractor Dunstervill's prices exhibited the amount to be no more than 6,691*l.* 7*s.* 4*d.* though according to the prices paid to the other contractor, Taylor, the savings appeared to amount to 12,742*l.* 8*s.* 10*d.* These discrepancies left an impression on the Board that it would be impracticable to ascertain the real amount of savings; but at length the task was imposed on Bentham. He has said, "there were circumstances attending this case of remuneration which, considering the various ways in which I was concerned in the production of the effect, rendered it to *me* a business of peculiar difficulty. There were savings derived from the use of improved machinery, savings of manufacturer's profit, and savings from good management in the concern as a manufactory. In regard to the savings from all these sources, it was either by Mr. Brunel's means or by mine that they had been produced." Having consented to the undertaking this disagreeable task, he entered into all details, *estimated* nothing, though Brunel and Rogers had both done so; the result of this tedious investigation was, that the total savings by manufacturing blocks in the Wood-mills amounted to 16,621*l.* 8*s.* 10*d.* a year. He then, as some said *generously*, others *foolishly*, waived his own share in the inventions, his merit as the introducer of good management, and recommended that the whole savings, however derived, should be awarded to Brunel.

This vast amount of remuneration to Brunel tended at the time, as it still tends, to excite a notion that the whole of the Wood-mill machinery was Brunel's; whereas, the greater part of the 20,000*l.* paid by the Treasury in 1813 to Jeremy Bentham, was on account of the expenses he had incurred in the year 1791 to 1795 for the construc-

* The writer of this was present on that occasion.

tion of machines of his brother Samuel's invention, and many of which, as above-mentioned, were in those Wood-mills.

That remuneration was accorded in conformity to provisions contained in the Act 52 of George the Third. It recites; that an agreement had been made by the Lords of the Treasury with Jeremy Bentham for the institution of a National Penitentiary-house; that "Jeremy Bentham states himself to have expended large sums of money in . . . an extensive system of mechanical works of the invention of his brother Brigadier-general Samuel Bentham, . . that the said Brigadier-general Bentham had relinquished in his favour such compensation as the said Samuel Bentham might be entitled to in respect of the matter aforesaid. And whereas . . . it is just and reasonable that the said Jeremy Bentham should be paid the sums so by him expended; and should moreover receive a liberal compensation for all loss and damage by him and the said Samuel Bentham sustained by reason of the non-fulfilment thereof:" it is thereupon enacted that arbitrators shall be chosen "for the purpose of settling all questions between the public and the said Jeremy Bentham."

Arbitrators were accordingly appointed as the Act directs, who, in July 1813, called before them various persons to give evidence respecting Samuel Bentham's machinery, some of whose depositions seem interesting as filling voids in the history of mechanical inventions, no less than they regard that of the Portsmouth Wood-mills in particular. It may not be amiss to say, that the 20,000*l.* awarded by the Arbitrators, although the whole of it was relinquished in favour of Jeremy, was far from reimbursing his expenditure on account of the machinery and intended Penitentiary; and that as to Samuel; he had sold all the estates left him by his father, in order to raise money for the completion of his machinery, but for which expenditure he never in any shape received a sixpence in return.

The Minutes of Evidence here made use of are those taken during the examination itself, consequently are brief, and free from all the dressing-up usual on a publication of evidence.*

"James Burr, master of the Wood-mills, Portsmouth Dockyard, examined 3rd July, 1813."*

"Was employed by General Bentham, in 1791 or 1792, for five or six years in making models.—Saw other persons employed in making machinery of various kinds.—Several species of saws.—Similar saws, and other machines, although upon a larger scale, are now in use in Portsmouth Dockyard.—Labourers alone are employed at the machines; and not a single tradesman.—The average earnings of the *men* is from 29s. to 30s. per week.—The expense of rebating by machinery is about one tenth of what it would be by hand.—A man who had been a convict did as much work in one day by rebating with the machinery as would come to 16s.8d.: and this man had only 12s. per week for his wages.

"Sir Samuel Bentham,

"Prepared a system of machinery for the employment of men without any skill, and particularly with a view to convicts, in 1792. Patents were taken out for the inventions to secure their exclusive use for the Penitentiary. No skill whatever was required in the use of these machines. Several of these machines have been introduced into Portsmouth-yard, and are worked by common labourers. The use of this machinery saves nine-tenths of labour, as well as cost in materials. Several parts of that machinery now used by various persons. Half the expense of labour saved in making a table. He superintended the machinery at Queen-square Place from 1792 to 1795. He thinks about 12,600*l.* was expended at Queen-square Place in the preparations. Mr. Bentham sold estates in Essex to find money.

"Adjourned on the 3rd to Monday.

"Monday 5th July, 1813.—General Bentham examined by Mr. Cook:

"Some of the materials now existing—some were taken to Portsmouth Dockyard. A great deal of the ironwork prepared for the building was sold—may be sold for between 100*l.* and 200*l.*.... Great part of the woodwork left to rot.†.... His inventions are now used at Portsmouth, a little at Plymouth, and by Mr. Brunel at Chatham.

"Mr. George Smart, examined by Mr. Roe:—Engaged in business in the year 1790—a carpenter and builder: in 1794, entered into a concern with John Trotter, army contractor, in preparing tent-poles, casks, canteens, &c. Did not employ any

* They have been furnished by a friend who stands high in the legal profession.

* *After* the abolition of Bentham's office, consequently no favour from his hands could be expected by Burr.

† Three or four very large pieces of oak, having been parts of machines, were still in the coach-house, Queen-square Place, in the year 1814.

machinery for the first twelve months; after the twelve months, employed machinery of various kinds for reducing labour. He first heard of circular saws being used from a Mr. Galloway: Mr. Galloway was in the employ of General Bentham . . . A labourer now, with a circular saw and the steam engine, may do as much as seven sawyers. The circular saw now used is the same he heard of from Mr. Galloway. He conceives he had the first circular saw that was made from a Mr. Mainwaring, from whom he purchased it about thirty-four years ago. Never used it till he heard of the circular saws being used from Mr. Galloway. General Bentham brought them into general use. The parallel guide invented by General Bentham. General Bentham made many other improvements."

By notes on the last page of the Minutes of Evidence, it would seem that Samuel Bentham's three patents of 1791, 1793, and January 24, 1795, were considered in the Arbitration as being each of them of the value of 3,000*l*.—together 9,000*l*.—a truly insignificant sum, compared to what might have been derived from a very moderate royalty for their use by private manufacturers.

It may be permitted to add, that the writer of the above saw a great number of the Bentham machines in a working state, and at work, in Queen-square Place, in the year 1794;—not only the window sash-frame and wheel-making apparatus, but also that for cutting veneers, for cutting ivory, for planing wood by one broad plane, thereby leaving the shaving in a state ready for laminated work; for cutting stone, at the same time leaving its surface smooth and almost polished; there was also, from Mr. Bentham's study to the servants' hall, a speaking-tube made of shavings from the laminating plane, and many other contrivances and machines for different purposes were also exhibited there, but the particulars of which, after the lapse of so long a time, cannot now be called to mind.

M. S. B.

April 2, 1852.

MR. CARTER'S HOLLOW MUSKET BALL.

Sir,—You did me the favour of publishing my remarks on musket balls, in your Number for February 7th, page 114, and, with your permission, I would address a word or two to your correspondent, Mr. George Carter. The plan of making the chamber of hollow cylindrical shot the receptacle for the powder, is anything but new; I have adopted it with the form of ball I proposed. Mr. Carter has not stated the requirements for the use of his form of shot. In the first place, it should be on a breech loading-gun, or what will he do with the accumulated patches of gutta percha at the breech end of the barrel?—and how will he fire the powder? If the cap D be taken off, and the powder emptied into the gun, he will find that his proposed ball will descend to the powder, but the chamber B will remain empty—consequently, dangerous. In the next place, the shape of his shot is, I think, wrong; the chamber being too deep, and the walls of the cylinder so thin, that the ball would be blown to pieces in passing out of the barrel. Again; the curve of the cone or head of the shot is the wrong way: practice has shown that the sugar-loaf shape is best. With Mr. Carter's formed shot, I question if the spiral indentations are of any use, and the abrupt shoulder at the junction of the head with the cylinder of the shot would present an unnecessary amount of resistance to the atmosphere. The plan which I have adopted to give a rotary motion to the ball, is simply forming two or three inclined cuts or notches on the shoulder; and I form the cartridge by attaching the powder to the head of the shot, in the ordinary manner: the screw of paper is detached, the powder passed into the barrel, the ball reversed and dropped on to the powder; and if the balls are made with care, and care be taken of them, they require no ramrod.

I have to apologize for the length of my letter; but should my remarks be considered of sufficient importance, I may trouble you with a line on a very simple arrangement for firing powder through the breech.

I am, Sir, yours, &c.,

WILLIAM MURRAY.

Churchyard-row, Newington-butts,
March 29, 1852.

PROTECTION OF INVENTIONS ACT, 1851 (EXTENSION OF TERM).

The following is a copy of the Bill brought in by Lord Colchester for Extending the term of the Provisional Registration of Inventions under "the Protection of Inventions Act, 1851."

"Whereas by 'The Protection of Inventions Act, 1851,' it was provided, That the provisional registrations of any new invention registered thereunder should continue in force for the term of one year from the time of the same being so registered. And whereas it is expedient that the said term should be extended: Be it therefore enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords spiritual and temporal and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

"The registration of every invention provisionally registered under the said Act shall continue in force until the 1st day of February, 1853, in like manner, and with the like effect and consequences, as if every such registration had been continued in force till that day by the said Act, instead of for the term of one year from the time of the invention being registered as therein mentioned."

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MARCH 31, 1852.

CHARLES WATT, of Kennington, Surrey, chemist. *For improvements in the decomposing of saline and other substances, and in separating their component parts, or some of them, from each other; also in the forming of certain compounds or combinations of substances, and also in the separating of metals from each other, and in freeing them from impurities.* Patent dated September 25, 1851.

The improvements here claimed comprehend—

1. A mode of decomposing, by the agency of electricity, saline or other substances in solution, by means of a vessel divided into two or more compartments, separated from each other by partitions of porous materials.

2. A mode of preparing or obtaining the metals of the alkalies and alkaline earths by the agency of electricity and heat.

3. A mode or modes of converting chlorides of potassium and sodium, and of the metallic bases of the alkaline earths, into hypochlorites and chlorates by the agency of electricity and heat.

4. The separating of metals from each other by the agency of electricity, and by means of vessels divided into compartments, separated from each other by porous partitions, and at the same time freeing such metals from impurities.

DAVID STEPHENS BROWN, of the Old Kent-road, gentleman. *For an improved agricultural implement.* Patent dated September 25, 1851.

The nature of this invention consists in the adaptation of revolving cutters or blades to till the soil; and the manner in which the invention is to be performed is as follows:

Upon a suitable framework the patentee mounts spindles, to the lower ends of which cutters or blades are fitted, and he communicates rotary motion to them by means of wheel gearing from any prime mover. The rotary motion of the cutters, and the manner in which they are disposed, cause them to enter, break up and pulverize the soil.

The drawings exhibit an arrangement of implement in which two sets of cutters are employed, one set in advance of the other, the spindles of both being placed in a downward inclined position. The front cutters are smaller than those placed behind them, and the sets of cutters do not follow each other in a straight line, but each cutter of the back set is made to follow in a line drawn from the centre of the space between two cutters of the front set. Motion is communicated by wheel gearing from cross shafts to both sets of spindles and to the cutters. The bearings of the cutter spindles are jointed to the framework, so as to allow of any particular spindle, or all the spindles and cutters, being raised out of the ground by means of quadrants, of which there is one for every spindle. If all the spindles and cutters are desired to be raised out of the ground, the bearings of the cross shafts are made to slide upon the framework, when the shafts may be taken back by means of handles a sufficient distance to put the wheels upon them out of gear with those upon the spindles of the cutters. The power—supposing it to be derived from a small steam engine mounted upon the framework of the implement, or upon a separate truck—is communicated to the spindles and cutters through the cross shafts by means of bands, pulleys, or cranks. When the machine is at work, it is propelled over the ground by horse or steam power.

The cutter spindles are shown placed in a downward inclined position, as being that which the patentee considers most suitable for the purposes of his invention; but he does not confine himself to any precise position, nor to any size or shape of the cutters, as both may be varied according to the nature of the soil to be operated upon; the distinctive features of the invention being, as before stated, the tilling of the soil by means of revolving cutters, arranged and disposed as shown.

Claim.—The improved agricultural im-

plement before described; that is to say, in so far as regards the employment therein of revolving cutters or blades, in the manner exemplified and described.

CHARLES GREEN, of Birmingham. *For improvements in the manufacture of brass tubes.* Patent dated September 25, 1851.

The improvements have reference to brass tubes made without seam or joint, such as are employed in steam-engine boilers.

The method of making this description of tubes as heretofore practised is as follows:—A tube is first cast of a size and thickness proportioned to the ultimate tube to be formed, which by successive operations of annealing, and drawing through dies, is reduced to the size of the tube required, and after the final drawing is annealed and pickled or treated in dilute acid to remove scales, and bring it into a condition for use. Now the patentee adopts the method following, that is to say, when the tube has passed through the successive annealing and drawing operations with the exception of the last drawing, he causes it to be annealed, and after pickling in dilute acid (as ordinarily practised after the final drawing) he immerses it in cold water, then boils in water for ten or fifteen minutes, and immerses in a soap solution composed by adding 3 lbs. of soft soap to 3 gallons of water. He then subjects the tube to an annealing operation, and draws it through a die or hole to bring it to the required size, applying soapsuds or solution to the parts of the tube immediately under the operation of the dies. Before inserting the tube in the boiler, he again anneals it at each end to the extent of about 6 inches at the end which enters the smoke-box, and of 1½ inches at the end which enters the fire-box. By this means a tube is produced stiff, strong, and perfectly smooth on the outside, and which, by acting as a stay to the boiler in which it is introduced, contributes materially to its durability and power of resisting internal pressure of steam.

Claim.—The modes described of manufacturing brass tubes.

RICHARD ARCHIBALD BROOMAN, of the firm of J. C. Robertson and Co., of 166, Fleet-street, London, patent agents. *For improvements in presses and in pressing.* (Communication.) Patent dated September 25, 1851.

Claims.—1. An improved construction of press, and arrangement of pressing machinery, in the general arrangement and combination of parts of which the same consists; that is to say, in so far as regards the employment of a revolving disc (the holes in which form the pressing cylinders) placed before a fixed plate or disc, in combination with feeding, pressing, and discharging pistons, as described.

2. An improved press and mode or system of pressing, whereby the substances are acted upon in layers or divisions, and forced into intimate contact with the superincumbent air and water, or other liquid, as described. Also the subjection of the substances while in layers, and in such state of intimate contact to the the action of a vacuum, as described. And, lastly, certain arrangements by which the substances are fed in portions or divisions, in conjunction with the perforated plates, into the bottom of the containing cylinder, and whereby they are removed at the top from time to time after being pressed, as described.

FREDERICK HALE THOMSON, of Berners'-street, gentleman, and GEORGE FOORD, of Wardour-street, chemist. *For improvements in bending and annealing glass.* Patent dated September 25, 1851.

These improvements consist in combining means and apparatus for bending sheets of glass into concave forms, to be used for reflectors and other similar purposes, and for annealing the same.

The method which the patentees adopt in carrying their invention into effect is as follows:—They take concave moulds—by preference, of cast iron, and as smooth as may be on the interior, and having a small aperture in the centre for the escape of air. These moulds are so constructed that they may be fitted in or on a vertical axis passing through the centre of the muffle or oven employed; which axis is so arranged as to be capable of being set in rotation, and of rising and falling for the purpose to be presently mentioned. The muffle which the patentees prefer is heated by two fires, one on each side exterior thereto, and the flames and heated products are caused to traverse the sides of the muffle through suitable flues, and to ascend and unite at about the top part of the muffle, so that the heat shall be greatest at the top. The moulding operation is performed as follows:—A mould is introduced into the interior of the muffle and supported on the axis; and when it has reached a dull-red heat, it is withdrawn from the muffle, and a plate of glass having been placed thereon, it is again introduced, and allowed to remain in the muffle, being gradually raised by lifting of the axis, so as to subject the glass to different and gradually-increasing degrees of heat, until it attains the bending point, which will be readily ascertained by the workman looking through an eye-hole. As soon as this is the case, the workman takes a convex

piece of soft wood or cork, dipped in water, and having set the axis in rotation, he applies the same to the sheet of glass on the mould, and continues to keep it in contact therewith, using for this purpose slight pressure until the glass is brought to the concave shape of the mould. He then takes out the mould and concave sheet of glass from the muffle, and having covered the same with a piece of sheet metal, sets them aside to cool. The cooling in this manner will be found to partially anneal the glass, and the process of annealing is subsequently completed by heating several such concave pieces or forms of glass in a muffle, and allowing the same to cool, as is well understood.

Claim.—The combination of means and apparatus described for bending and annealing glass.

Ernst Kaemmerer, of Blomberg, Prussia, iron-founder. *For improvements in sowing, depositing, or distributing seeds over land.* Patent dated Sep. 25, 1851.

Claims.—1. A combination of parts forming a machine for sowing broad-cast.

2. The same for sowing in drills.

3. The same for dibbling, or sowing at intervals.

4. A system or mode of constructing the seed-chambers so that the quantity of seed flowing from the seed-receiving chamber through the apertures to the seed-distributing chamber shall have a due proportion to the quantity taken up by the buckets and delivered into the funnel of the machine.

5. A peculiar form and section of bucket.

6. A peculiar construction and arrangement of the bucket wheels and rings, by means of which the sets of buckets attached to the rings may be removed and changed as required.

7. A peculiar arrangement of the seed-conducting tubes, by means of which the seed, in being delivered to the drills, is divided into different proportions as required; and also certain arrangements by which the vertical position of the conducting tubes is preserved on hilly ground.

8. A peculiar arrangement of seed-distributing board, with dividing blocks and distributing pegs of cane, whalebone, or other elastic or suitable material. (The patentee does not claim the use of the distributing board when made with dividing blocks alone, but only when pegs are used in combination with the blocks.)

9. The use of slides, by means of which the seed-distributing chamber may be emptied in an expeditious and easy manner.

10. A system or mode of changing the quantity of seed to be delivered over a given distance, by means of sets of change wheels of various speeds.

Robert Roberts, of Dolgelly, Merioneth, mine-agent. *For an improved method of quarrying certain substances.* Patent dated September 25, 1851.

This improved method is applicable to the quarrying of slate, rock, and other similarly laminated substances which are required to be raised in blocks, tables, or plates.

The method of quarrying usually adopted is that in which the tables, plates, or blocks are raised by blasting; but this is considered objectionable, inasmuch as blocks are obtained in irregular forms, and the waste of material in reducing them to a proper shape is, in consequence, very great. To obviate these disadvantages, the patentee proposes, in cases where one or more sides of the block to be removed are exposed, to form an artificial foot-joint or cut, or two such joints or cuts, and then to wedge off the block, plate, or table so as to obtain the same of any desired size or thickness. The patentee describes several arrangements of boring and other tools for carrying his invention into effect, and claims—

The quarrying of slate, rock, and other laminated substances in the manner described.

Specification Due, but not Enrolled.

James Garforth, of Dukinfield, Chester, engineer. *For certain improvements in locomotive steam engines.* Patent dated September 25, 1851.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Jean Jacques Bourcart, of the firm of Nicholas Schlumberger and Company, of Guébwiller, France, for improvements in preparing, combing, and spinning wool and other fibrous materials. (Being partly a communication.) March 27; six months.

William Thompson, of Salford, Lancaster, machine-maker, and John Hewitt, of Salford aforesaid, machine-maker, for improvements in machinery for spinning, doubling, and twisting cotton and other fibrous substances. March 27; six months.

James Melville, of Roebank Works, Lochwinnoch, Renfrew, North Britain, calico-printer, for improvements in weaving and printing shawls and other fabrics. March 29; six months.

James Timmins Chance, of Handsworth, Stafford, glass manufacturer, for improvements in the manufacture of glass. (Being a communication.) March 29; six months.

Charles Jack, of Tottenham-court, New-road, for improvements in machinery for grinding pigments, colours, and other matters. March 29; six months.

John Whitehead, of Holbeck, York, machine-manufacturer, for improvements in machinery for preparing, combing and drawing wool, silk, and other fibrous substances. March 29; six months.

John Flack Winslow, of the City of Troy, in the State of New York, in the United States of America, iron-master, for improvements in machinery for blooming iron. March 31; six months.

Moses Poole, of the Patent Bill-office, London, gentleman, for improvements in fire-arms. (Being a communication.) March 31; six months.

LIST OF IRISH PATENTS FROM THE 21ST OF FEBRUARY, TO THE 19TH OF MARCH, 1852.

George Gwynne, of Hyde-park Square, Middlesex, Esq., and George Ferguson Wilson, managing director of Price's Patent Candle Company, of Belmont, Vauxhall, for improvements in treating fatty and oily matters, and in the manufacture of lamps, candles, night lights, and soap. February 24.

Hermann Turck, of Broad-street Buildings, London, merchant, for improvements in the manufacture of resin oil. (Communication.) Feb. 24.

William Jean Jules Varillat, of Rouen, France, for improvements in the extraction and preparation of colouring, tanning, and saccharine matters, from various vegetable substances, and in the apparatus to be employed therein. March 15.

Charles Middleton Kernot, of West Cowes, Isle of Wight, doctor of philosophy, and William Hirst, of Manchester, for certain improvements in the manufacture of woollen cloth, and cloth made from wool, and other materials, and in machinery and apparatus for manufacturing the same. March 15.

Sir John Scott Lillie, of Pall-Mall, Middlesex, Companion of the Most Honourable Military Order of the Bath, for certain improvements in the construction and covering of roads, floors, walls, doors, and other surfaces. March 16.

John Wormald, of Manchester, Lancaster, maker-up and packer, for certain improvements in machinery or apparatus for spinning and doubling cotton, wool, silk, flax, or other fibrous substances. March 16.

Henry Glynn, of Bruton-street, Berkeley-square, gentleman, and Rudolph Appel, of Gerard-street, Soho, anastatic printer, for improvements in the manufacture or treatment of paper or fabrics, to prevent copies or impressions being taken of any writing or printing thereon. March 16.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Mar. 26	3196	Simcox, Pemberton and Sons	Birmingham	Rack-pulley.
27	3197	Arthur James	Redditch	Needle-case.
,,	3198	James Coombe & Co	Belfast	Flax-holder.
29	3199	E. de Maignol Mataplane	South-street, Finsbury	Circular tilting platform.
,,	3200	Hall and Wilson	King-street, Manchester	Trimmer, or beam for supporting hearth stones.
,,	3201	W. B. Johnson	Manchester	Steam-pressure gauge and signal whistle.
,,	3202	Michel Roch	South-street, Finsbury	Letter envelope.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

Mar. 27	386	John Dicker	Clarence-terrace, Islington	Traductor.
,,	387	J. J. Catterson	Cloudesley-terrace, Islington	Compound carriage spring.
29	388	J. T. Campion	Exeter, surgeon	Mould for casting hollow or Minié rifle bullets.
,	389	William Redgrave	Grafton-street, Fitzroy-square	Cricket guard

CONTENTS OF THIS NUMBER.

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MAIN'S CONDENSING STEAM-ENGINE AND DOUBLE-SCREW PROPELLING MACHINERY.

Fig. 1[1].

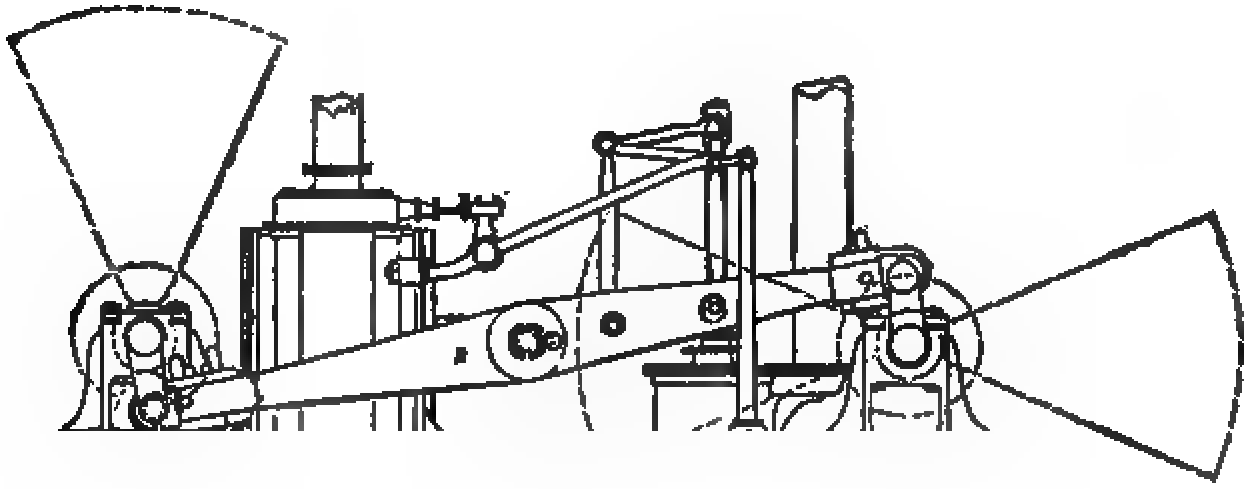
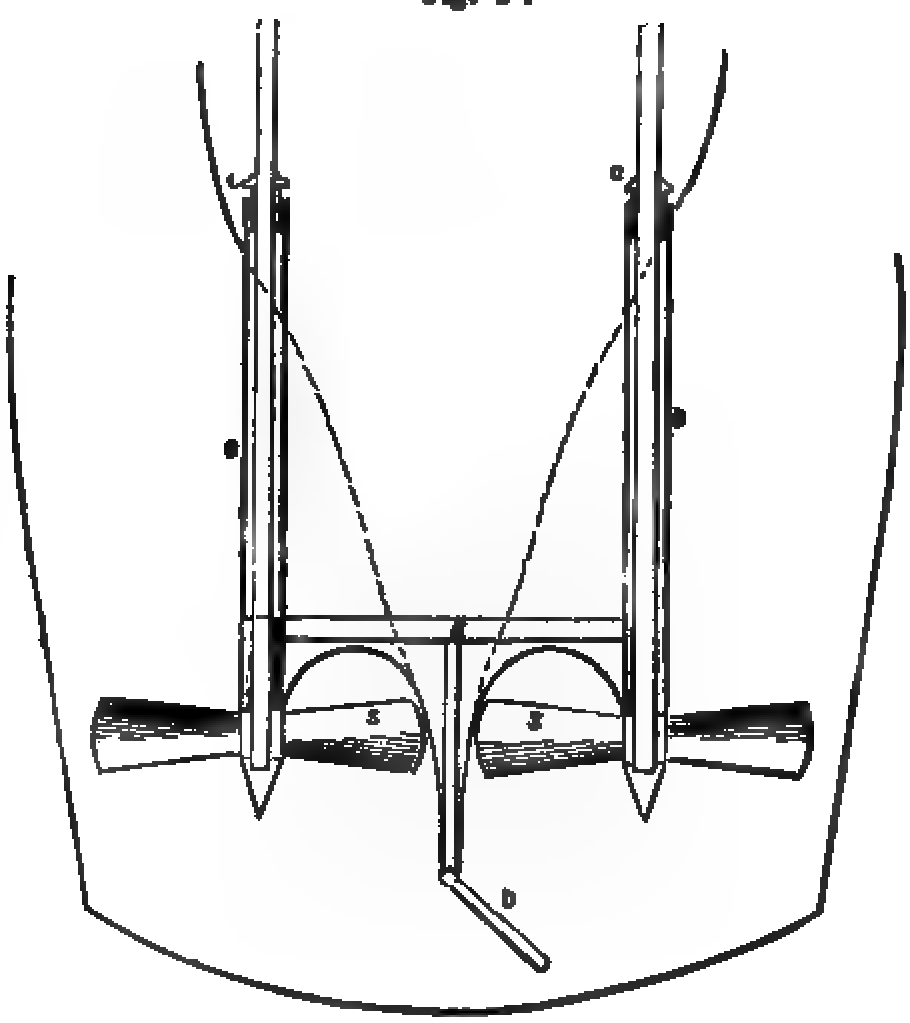


Fig. 2[1].



MAIN'S CONDENSING STEAM-ENGINE AND DOUBLE-SCREW PROPELLING MACHINERY.

In addition to the improved arrangements of steam machinery given in our last two Numbers, Mr. Main has described in the specification of his patent another, which is well deserving of attention, though perhaps more on account of its practical dexterity than absolute originality.

It consists of a condensing engine and double-screw propelling apparatus, remarkable for the simple way in which the air or other pumps are *vertically* secured to the bed-plates, and worked direct by the connecting-rods at a part of the stroke of the piston, and strikingly corroborative of the advantage which yet remains to be derived from the employment in screw-propelling of two screws instead of one (as previously proposed by Captain Carpenter and others). The following is Mr. Main's description:—

My invention consists of an adaptation of the duplex engine, before described, to the case where motion is required to be given to two shafts, as, for instance, where there are two screws, or wing propellers, employed one under each quarter of a ship. Fig. 1[b] is an elevation of this arrangement, showing two screw or other propellers. In this case the two cylinders are laid horizontally, while the air-pumps are fixed vertically, and the working parts are composed of two connecting-rods BB, working from the ends of the piston cross-head as a centre, and connected by their two ends direct to the two crank-shafts. The two shafts again are so connected as to revolve in opposite directions, causing the centre of the connecting rods to move in a straight line, which coincides with the path of the piston cross-head, thereby superseding entirely all necessity for parallel motion or guides. The air-pumps, it will be observed, are worked by means of the combined motion of the revolving cranks and the stroke of the piston. Or instead of two connecting-rods one only might be employed, working through a crank, and connected with the air-pump cross-head by guides or otherwise. This description of engine may be made with one connecting rod working through a trunk cylinder, and in this case the air-pump cross-head might be contained in guides.

My invention consists also of an improved method of fitting the shafts where two screw or wing propellers are employed one under each quarter of a ship. Fig. 2[b] is a longitudinal plan exhibiting the details of this proposed arrangement. The shafts are contained in strong cases or trunks B of wrought iron carried through the ship's quarters, and extended sufficiently aft to support the screws, SS, in the fine run of the ship, or concave sweep immediately before the rudder D. These trunks are worked into the framework of the ship, and not only firmly supported internally by cross-stays, but connected to each other by diagonal bracing, so as to resist effectually any strain which may be given out by the engine in working the screws or other propellers; and at the points where they come through the ship, they are fitted inside with stuffing-boxes CC. Or, instead of the preceding arrangement, the crank of each shaft may be carried out through the ship's quarter, as far as the screw, and supported at the outer end by a wrought iron bracket E with arms. The shafts may be made to disengage from the engines, or draw back in the usual way, and the screws or other propellers may be shipped or unshipped through apertures in the quarters, or lowered and hoisted over the counter by suitable apparatus.

THE STEAM WHEEL OR VALVELESS ROTARY ENGINE.

This engine may be found described at page 129 of the current volume of this Magazine; and the following remarks may be regarded as a continuation of those with which that article concludes. Their purport is to give some account of the mode by which that engine might probably be worked, and to state some further advantages that might attend its adoption, should its principle be found to be correct.

If the temperature of steam be gradually augmented, the pressure increases in a much greater ratio than the heat: it is not improbable it may follow a very general law, and the pressure increase as the square of the heat. Whether this be the rule or no, it is undoubted that steam increases in a much greater proportion than the temperature: so that it needs no argument to prove that it would be cheaper to employ less steam at a great pressure, than a great quantity at low pressure. If, for instance, we take a 6-inch cylinder, worked by steam at a pressure of 56 pounds to the circular inch,—a not uncommon size and pressure for a high-pressure engine,—we have then a total pressure of 18 cwt. on the piston. If, however, the pressure of the steam were increased to 2 cwt. on the circular inch, the same total pressure might be obtained with a cylinder only half the diameter, or 3 inches. And as the pressure increases so much more rapidly than the heat, it might be cheaper to supply a 3-inch cylinder with steam at the higher pressure, than a 6 inch cylinder with the lower-pressure steam. But however advantageous the employment of the high-pressure steam might be, it is manifest it could not be conveniently adopted with the ordinary steam engine; for, to say nothing of the want of proportion in a steam engine with a cylinder of so small a diameter, the piston-rod would require to be of the necessary strength, and its diameter would come to be a matter of consideration; for owing to the space it would occupy in the interior of the cylinder, the downward stroke would cease to be so efficient as the upward. The above statements as to the greater cheapness of high-pressure steam are borne out by experience, for those engines which are professed to be worked at less expense than others, generally work at higher pressure. But though it may be desirable to employ steam of great pressure, it would appear that in the ordinary engine there is a limit to the pressure at which steam can be employed. The advantage of employing such high-pressure steam would be most felt with the more powerful engines: and it is, in fact, with this class of engines that the steam might be raised to the greatest pressure; for as the pressure increases in a far greater ratio than the heat, it might be found beneficial to employ with engines of great power a pressure of several cwt. to the inch: for steam is a power which may be increased almost without limit. Such great pressure would, however, not be suited to the ordinary engine, and if it be adopted it must be with some other engine.

To recapitulate, then, the statements I have made are three; first, that with steam, pressure is cheaper than quantity; second, that with the ordinary steam engine there is a limit to the pressure at which steam can be employed; and third, that if it be desired to employ steam of higher pressure, some other form of engine must be adopted, and which is probably the one I am now proposing.

Besides the increase of pressure, steam at a great heat becomes highly rarefied; and it is not improbable, that as water at a certain temperature,—namely, 212°,—passes into steam, so steam again, at a still greatly-increased temperature, may pass into something yet higher than itself. Though what that essence or vapour is, or what the temperature at which it forms, have as yet received no investigation. This essence may probably be as much higher than steam as electricity is than gas; and, in fact, it may bear the same relation to negative and positive electricities, that steam does to oxygen and hydrogen gases. Steam at very high pressure is attended with electrical phenomena; and should the above conjecture prove correct, then this engine, which would probably require the steam to have attained this state, may be regarded rather as an electrical engine than a steam one.

The pressure necessary to turn this wheel *with power* would probably be

very great, but the quantity of steam or electric vapour required would be but small, and the heat might probably be maintained with only a moderate amount of fuel. There are cases,—as, for instance, that of a rapid locomotive,—where it might be advantageous, if not necessary, to employ steam at a great pressure, rather than having to evaporate a great quantity in only a short space of time.

The following are some of the advantages that I think would be found to attend the adoption of this engine, should it be proved to be successful:—

For locomotives, I have already spoken of the advantages of this kind of engine over the ordinary kind. It would attain a far greater speed than any engine with a reciprocating motion, and would be much superior to any complex arrangements of compound wheels. In the ordinary locomotive much power is required to work the slide valves, owing to the pressure of steam upon them; and when the engine is working rapidly the steam does not escape from the cylinder with sufficient rapidity, so that power has to be exerted in expelling it. This power has been estimated at 40 per cent., and in swift locomotives it is not improbable that nearly one-half the power of the engine is employed in overcoming the imperfections attending it. Hence improvements are constantly being made in this kind of engine, and it becomes almost a question whether some other form of engine might not advantageously be adopted.

For mills, besides its general advantages, I think, that with a suitable governor, it would attain a greater regularity and precision than even the best ordinary steam engine; a matter of great importance for all spinning purposes.

For pumping, it may perhaps not be much superior to the ordinary engine; as it is in pumping perhaps that the steam engine has attained its greatest perfection. The locomotive, indeed, may be more skilful mechanism, but cannot be considered so perfect for the work it has to perform, inasmuch as the motion has to be changed from alternate to rotary. It may, however, be found suitable for this purpose; and for the centrifugal pump it would probably be superior.

For steam vessels, should my anticipations be realized, it would be very advantageous, as with the same weight of metal, and the same amount of fuel, double the power might be obtained on this principle, as on that of the ordinary engine.

Besides its general advantages; viz., its simplicity, reduced prime cost, less expense in the working, &c.; this engine will also continue in operation for a great length of time with little or no repair, for the only parts liable to any particular wear are the orifices, which may perhaps become widened, and consequently allow a greater quantity of steam to pass through, not however without increasing the power.

In conclusion; I may remark that this engine is constructed on the principle of the Greek æolipile,—an instrument described at p. 490 of the present volume. This instrument is generally regarded as a mere scientific curiosity or toy, but it has now for some years been practically demonstrated that power can be obtained from it. Engines of considerable power, of 20-horse and upwards, have been formed on this principle; and of all the forms of rotary engine, this has obtained the most general adoption. Its working is said to be very efficient, and it is not improbable that it is worthy of more attention on the part of scientific engineers than is generally bestowed upon it. Its principle appears likely to contain the true solution of that long-desired problem of constructing a wheel to rotate by the immediate application of steam. The wheel I have suggested on this principle may perhaps not be the correct one; it has however this advantage over the rotary engine, that the steam passes through two apertures instead of one. The steam not only passes through the apertures of the near spokes, as in the ordinary manner, repelling them from it, but also enters the apertures of the fan-spokes, drawing these towards it. This alteration might be adopted in the ordinary rotary engine, by placing the arms or spokes as on the plan I propose, and leaving out the rim entirely: that the same steam would as it were perform a double office, and should it be found that this alteration causes the rotary engine to take as much less steam than the ordinary engine, as what it now takes more, it would have a great effect on its more extended adop-

tion. Should it be found practicable, I think this engine will be superior to any other, in almost every point which it is desirable for an engine to possess. It will be found superior to the alternate action of the cylinder and piston, and it is perhaps the only engine without any reciprocating action whatever, as I believe all other rotary engines possess valves of some kind or other. For rapid motion it would be unequalled; and as it was the earliest means by which motion was obtained by steam, so experience may yet prove that it was not only the earliest, but is also the best.

M. G.

IMPORTATION OF FOREIGN INVENTIONS.—THE NEW PATENT LAW BILL.

Sir, — In the Bill now before the House of Lords, it is proposed by clause xxv. to enact, "That the use or publication in any foreign country, or in any of the Channel Islands, or in any of Her Majesty's Colonies, dominions, or possessions abroad, of any invention before the date of any Letters Patent to be granted for such invention under the provisions hereinafter contained, shall have the like effect with respect to such Letters Patent as if such use or publication had taken place in the United Kingdom of Great Britain and Ireland."

It would I think, Sir, be impossible to contrive a more impolitic clause, and one more at variance with equity, with common sense, and with the true and legitimate interests of the nation.

In effect, it must be readily perceived that the invention or importation of any process hitherto unknown or unused is a clear benefit for the country where it is put in practice; for it is an addition made to the social fund, and to the public wealth without any loss, damage, risk, or even expense being incurred by the people. To legislate, therefore, that the use or publication of an invention in any foreign country shall not be protected in this realm, is not only depriving the people, without motive or reason, from the advantages which may be realised in those foreign countries—it is preventing England from keeping pace with them, and jeopardizing the exalted position which her industry has acquired, and which she holds among the civilised nations of the earth; nay, it is striking at the very root of civilization, for invention and civilization are convertible terms.

It will be answered, perhaps, that far from foregoing the advantages which may accrue from foreign inventions, the contemplated law will, on the contrary, enable England to realise these advantages for nothing, without having to pay for it a fourteen years' monopoly. But, apart from the meanness which characterises such an answer, namely, that of taking advantage of the labours of others without remuneration—who that has the least experience in commercial matters will believe that any individual will ever take the trouble of importing a new invention, or venture capital, sometimes to a very considerable amount, to introduce and work it, or will gratuitously undergo the Herculean labour of overcoming deeply-rooted prejudices, and submit himself to the host of nameless miseries which every novelty entails on their authors and abettors, unless there be a guarantee given that he may reap the fruit of his labours, of his experience and expenses, steadfastness and perseverance?

The first importer of a process, of a machine, of an invention of whatever kind, unknown and unused before in the country where he introduces it, is clearly in the position of a first occupant, and as such should be entitled to undisturbed possession; for occupancy in the words of Blackstone, "is the taking possession of those things which belonged to nobody, and is the true ground of all property—

"'Quod nullius est id ratione naturali occupanti conceditur.'"

It is true that there is less merit in importing than inventing, but, practically, the results are the same; in either case the public are benefited either way to the same extent, and consequently should grant the same reward. In fact, generally speaking, imported inventions being those the value of which has been confirmed and sanctioned by actual experience, it follows that they are, above all inventions, those in which the public are most interested, and consequently those for the admission of which the doors of protection should be most widely opened. Were not the law already existing, it

would be necessary to make one, decreeing that the owners of imported inventions should hold their possession by as firm a tenure as if both they and the invention were of native origin, instead of disabling them by the promulgation of a kind of *jus albinatus* in an aggravated form, for the contemplated measure not even waiting for death, would at once confiscate the inventions pending the very life of the possessor.

I am of opinion that the proposed measure, if carried, will be fatal, not only to foreign, but to native inventors. For who, I would ask, unless he be mad, or of a gambling disposition, would dream of risking funds for obtaining or working a patent in presence of a law which requires that an inventor should know all that has been done, or written in any country and in any language, and which declares that a patent shall be null and void because something, in some manner bearing upon the subject, may have been published, talked of, hinted at in some more or less remote corner of the planet, or because some book-worm may have ferreted out or stumbled upon a line or two in some unheard of or forgotten publication alluding to the same matter? I will venture to say, Sir, that there is not one patent, either now obtained or henceforth to be granted, which could successfully stand such an ordeal; there is not one scheme, process, or invention, against which a few lines in some language or other may not be brought to bear. The old law required that a patented invention should be new — that it should not have been published or put in practice, but it held that publicity was limited to the English possessions, and to the English language. No English subject was before now required by law to know any other language but his own. Now, however, there will be no alternative—he must be polyglot, or forfeit his rights.

Let us not forget that, in general, every invention is in reality the offspring of the ideas disseminated everywhere. Many inventions, impossible or unsuccessful at one time from the imperfection of tools, of machines, and a host of other causes, become at another period perfectly possible, and may be easily realised with better instruments—with a more advanced state of workmanship—or on account of the discovery of other processes which may be brought to bear upon inventions, which, though correct in principle, were formerly rejected or abandoned for the want of these new resources. The history of all ages bears testimony to this fact, and it is for that very reason that almost invariably something can be found to have been published relating to the newest and most undisputed inventions. The principle of the hydraulic press was known more than a century before Bramah patented the machine. The galvanising of iron had been tried and abandoned upwards of fifty years ago by Malouin; but it is only fifteen years since that Sorel succeeded in zincing iron in a practical manner, &c. That is to say, generally speaking, the inventor is in reality nothing else than the arranger of things already known, so as to produce novel effects of a practical or commercial value. An Englishman can, to a certain extent, be legally presumed to know what has been done, produced, or written in his own country, or in his own language, and he may then judge for himself of the degree of relationship which it bears to his own contrivance, but with the declaration laid down in the twenty-fifth clause of the proposed Bill, how can he do so? Surely, it is already hard enough for an inventor to run the risk, after having spent a great portion of his time, may be of his life, and a good deal of his substance in bringing his discovery to maturity, and in securing letters patent for it, of being received by the litigations in which unprincipled individuals subsequently involve him by disputing the novelty of his invention as to these realms, without fastening upon him the impossible and absurd obligation (absurd because impossible) of first ascertaining what has been written in the 804 languages of the nations who were represented in the Great Exhibition.—*Væ inventori!*

If what I have said be true, and it is true, what would be the consequence of the proposed new law? That instead of publishing his processes, which is one of the conditions of the patent grant, each inventor will lock and treasure them up in his breast or work them in secret, and thus each ceasing to contribute to the common fund, England will remain almost stationary, her best and noblest children will emigrate, and carry their

genius to more favoured and liberal lands. Instead of taking the lead, England will laboriously drag on an emaciated and jaundiced life; for new processes will find their way there, only when exploded elsewhere by the discovery of newer and better contrivances, which, remaining unknown to her, will henceforth leave her to thrive as best she may upon the cast-off improvements of other people.

The extreme absurdity, and mischievousness of the clause under present consideration is, I should say, so obvious that I would rather suppose that its contriver or contrivers wrote it unguardedly, and without reflection; this cannot be, however, for I find in the recitals of the petition and of the declaration, p. 20—and again in that of the Letters Patent, p. 22—that the petitioner is requested to declare that he conceives himself to be the true and first inventor, without reservation as to *this realm*, which amounts to neither more nor less, than saying that the petitioner conceives himself the first and true inventor *within this world!* — An ambitious assertion which I think no man in his senses would venture to make, and which the projectors of the Bill could not, would not—*durst* not ask.

I am, Sir, yours respectfully,
A. NORMANDY.

HISTORY OF WOOD-CUTTING MACHINERY.

[In the paper on this subject contained in our last Number, by our distinguished and much-esteemed correspondent "M. S. B.," special reference is made to a lecture recently delivered by Professor Willis, at the Society of Arts. We have since obtained a copy of that lecture, and in order that our readers may the better appreciate the value of the Professor's testimony to the great services rendered to mechanical science by the late General Bentham, we now add a few extracts. ED.]

The object of machines for working in metal, wood, and other materials, is to work rough material into shape, which may be done in three different ways: — (1.) By abrading or cutting off the superfluous portions in the form of chips or large pieces; (2.) If it possess ductility, we knead it, or press it into form in various ways, as by hammering, rolling, drawing, &c.; (3.) If it be fusible, we melt it, and pour it into a mould. I forbear to include the producing a given form by joining together pieces, because each piece must be shaped in one or other of the above ways. The most interesting series of machines is that which belongs to the first group; and to this I must, for the present, confine my attention. It may be interesting to sketch the history of their introduction. Machines of this kind are either general, like the lathe or the planing-machines, which are used for a great variety of purposes, or are especially adapted to the production of a single object of manufacture; in which case they are often contrived in a series, as the block machinery, the machines for making cedar pencils, and the like, and the introduction of such special machines is of great importance, and has certainly not yet reached its limits. As the machines of this latter kind are commonly modifications of one or other of the first, the history of the two must be considered together.

The origin of the turning-lathe is lost in the shades of antiquity, and the saw-mill, with a complete self-action, turned by a water-wheel, is represented in a manuscript of the 13th century at Paris, and is probably of much earlier contrivance. The lathe was, in process of time, adapted to the production of oval figures, twisted and swash-work, as it is called; and lastly, of rose-engine work. The swash, or raking mouldings, were employed in the balusters of staircases and other ornaments at the period of the Renaissance in architecture, about the end of the sixteenth century, and therefore the swash-lathe assumes somewhat of the character of a manufacturing machine. But the simple lathe was much employed in screen and stall work during the middle ages. The first real treatise on turning is Moxon's (1680), which gives us a valuable picture of the state of the art at that period; and he has preserved to us the name of the engine manufacturer of that day, Mr. Thomas Oldfield, at the sign of the Flower-de-Luce, near the Savoy, in the Strand, as an excellent maker of oval engines, swash engines, and all other engines, which shows that such machines were in demand. A few drawings of such machines occur in earlier works, beginning with Besson, in 1569. From the treatise of Plumier, published at Lyons in 1701, we learn that turning had long been a favourite pursuit in France with amateurs of all ranks, who spared no expense in the perfection and contrivance of elaborate machinery for the production of complex figures. This taste continued, at least, up to the French revolution, and contributed in a very high degree to the advancement of the class of machinery that forms the subject of our present lecture. In our own country the

literature of the subject is so defective that it is very difficult to discover what progress we were making during the seventeenth and eighteenth centuries. A few scattered hints only can be collected, whereas in France the great "Encyclopédie" and other works, abundantly illustrated, give the most precise and accurate knowledge of the state of this and other mechanical arts.

Smeaton has recorded that, in 1741, Hindley, the clockmaker of York, showed him a screw-cutting lathe, with change-wheels, by which he could, from the one screw of the lathe, cut screws of every necessary degree of fineness, and either right or left-handed. It seems to be implied that this was a novelty, and that Hindley had invented it; and it was soon imitated by Ramsden, and is now universal. At all events, such a machine is not alluded to in the French works already mentioned, and serves to show the advance we were then making in the practical improvement of the lathe.

But the clockmakers, to which body Hindley belonged, were the first who employed *special machines* for their manufactures. Their *wheel-cutting engine* has been ascribed to Dr. Hooke, about 1655, and its use rapidly spread over the continent. The gradual improvement of this machine, and the successive forms which it assumed as the art of construction was matured, forms a very instructive lesson. But herein our own countrymen have largely contributed to its perfection. Henry Sully, an English clockmaker, who removed to Paris about 1718, carried with him, amongst other excellent tools, a cutting-engine, which excited great admiration there. The form of the present French engine is, however, derived from Hulot's machine (about 1763). But our English engines, in which the dividing-plate is superseded by a train of change-wheels, so contrived as to require an entire turn of a latch-handle for each shift, and thus secure against error, is derived from Hindley's engine, which he showed to Smeaton in 1741, and which finally passed into the hands of Mr. Reid, of Edinburgh.

The *fusee-engine*, which is another special clockmaker's machine, must have greatly contributed to the perfection of machines for working in metal.

But the next great step towards the perfection of machine tools was the *slide-rest*. The slow and gradual way in which this invaluable device acquired the distinct and individual form in which it now exists, is a very curious example of the history of machinery, the development of which at length would occupy too much space on the present occasion, even if it could be made intelligible without drawings. Suffice to say, that although as early as 1648 Maignan published at Rome* drawings of two curious lathes for turning the surfaces of metallic mirrors for optical purposes, in which the tool is clamped to frames, so disposed that when put in motion it is compelled to move so as to form true hyperbolical, spherical, or plane surfaces, according to the adjustment, and that although the fusee-engines, screw-cutting lathes, and other contrivances already alluded to, employed tools guided by mechanism, yet the real slide-rest does not make its appearance until 1772, when in the plates of the French "Encyclopédie"† we find complete drawings and details of an excellent slide-rest, as nearly as possible identical with that usually supplied by Messrs. Holtzapffel and other makers of lathes for amateurs. It must have been contrived a little while before this publication; but the meagre descriptions that accompany the plates leave us completely in the dark with respect to its history. Bramah's slide-rest of 1794‡ is so different and so inferior in convenience, that the two could not have had a common origin; and we must suppose that the French slide-rest was unknown to that ingenious mechanist, although it is scarcely possible that copies of the "Encyclopédie" should not have found their way into our libraries.

But the improvements of the steam engine, its application to giving motion to the wheels of mills and other machines, the increasing employment of iron, and other advances in the construction of mechanism which were now developing themselves, gave men courage to devise and carry out large and extensive schemes for the application of machinery to manufactures. In our especial department we may record, as an early example, Bramah, who, in 1784, obtained the patent for his admirable lock, and immediately set about the construction of a series of original machine tools, for shaping with the required precision the barrels, keys, and other parts of the contrivance, which, indeed, would have utterly failed unless they had been formed with the accuracy that machinery alone can give. In Bramah's workshop was educated the celebrated Henry Maudslay, who, as I am informed, worked with him from the year 1789 to 1796, and was employed in constructing the principal tools for the locks.

Foremost among the ingenious persons who carried on this great movement must be recorded Brigadier-General Sir Samuel

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* "Perspectiva Horaria," p. 689.
† Tom. x. pls. 37, 38, 84, 85, 86.
‡ Weale's Edition of "Buchanan's Mill-work."

Bentham.* From his own account it appears, that in 1791 steam engines in this country were extensively employed for pumping mines, and for giving motion to machinery for working cotton, and to rolling-mills, and some other works in metal; but that in regard to working in wood steam engines had not been applied, for no machinery other than turning-lathes had been introduced, excepting that some circular and reciprocating saws and working tools had been applied to the purpose of block-making by the contractors who then supplied the blocks to the Navy; even saw-mills for slitting timber, though in extensive use abroad, were not to be found in this country.

General Bentham had at this time made great progress in contriving machinery for shaping wood, as is sufficiently shown by his remarkable specifications of 1791 and 1793; and he informs us that, rejecting the common classification of works according to the *trades* or *handicrafts* for which they are used, he *classed the several operations that have place in the working of materials of every description according to the nature of the operations themselves*, and, in regard to wood particularly, contrived machines for performing most of those operations whereby the need of skill and dexterity in the workman was dispensed with, and the machines were also capable of being worked by a steam engine or other power. Besides the general operations of planing, rebating, mortising, sawing in curved, winding, and transverse directions, he completed, by way of example, machines for preparing all the parts of a sash window and of a carriage-wheel, and actually showed these and other machines in a working state in 1794 in London.

This led to his appointment as Inspector-general of Naval Works, for the purpose of introducing these and various other machines into the Royal Dockyards, which he immediately set about effecting. From this time (1797) the introduction of machinery for the preparation of blocks and other works in wood at Portsmouth, Plymouth, and other Government establishments, takes its origin. In 1802 the General received a most powerful and efficient auxiliary in the person of Mr. Brunel, who in that year presented his plans for the block-making machinery. His services being immediately secured, and Mr. Henry Maudslay engaged for the construction of the mechanism, the admirable series of machine tools were finished and set to work in 1807, by which every part of the block and its sheaves are prepared.

The completeness and ingenuity of this system, the beauty of its action, and the novelty of the forms and construction of the whole of the mechanism, excited so much admiration that the whole of the machinery in Portsmouth Dockyard has usually been popularly ascribed to Mr. Brunel alone. It must not be forgotten, however, that much machinery for the performance of isolated operations had been previously employed, as well by Mr. Taylor of Southampton, the contractor for the blocks for the Navy previously to 1807, as by General Bentham himself in the Dockyards.

At this distance of time it would be impossible to discover the exact shares of merit and invention that belong to Brunel, Bentham, and Maudslay, in this great work. To the first we may, however, assign the merit of completing and organising a system of machine tools, so connected in series that each in turn should take up the work from a previous one and carry it on another step towards completion, so that the attendant should merely carry away the work delivered from one machine and place it in the next, finally receiving it complete from the last.

Some of the individual machines in the series had, it is true, been previously contrived and employed. Thus, the self-acting morticing-machine is distinctly described to Bentham's specification of 1793, so completely as to entitle him to the full credit of the invention of mortising-machines, whether by the process of boring a hole first and then elongating by a chisel travelling up and down vertically, or by the process of causing the hole to be elongated by the rotation of the boring-bit during the travelling of the work. The same specification describes boring-machines, some of which are similar in their arrangements to those of the block series; also the tubular gouge which is employed in the shaping-machine, and the formation of recesses, by a revolving and travelling tool, for the inlaying of the *coaks*.

One of the most useful machine tools that made its appearance at the end of the eighteenth century was the *circular-saw*. This had been applied to cutting metal on a small scale, as in the cutting-engine, ever since the time of Dr. Hooke; if, indeed, these early examples were not more like circular-files than saws. Where or by whom the wood-cutter's saw was put into the form of a revolving disc has not been recorded. It found its way into this country about 1790, some say from Holland, and was employed at Southampton and elsewhere in wood-mills. Bentham greatly

* Bentham's patents. "Repertory of Arts," vol. v. p. 293, and vol. x., pp. 221, 293, 367; also Memoir, by Lady Bentham, in Weale's "Quarterly Papers on Engineering," vol. vi.

contributed to the practical arrangements necessary to give it a convenient form. He describes and claims the bench now universally used, with the slit, parallel guide, and sliding bevel-guide, and other contrivances.* Brunel introduced a variety of ingenious and novel arrangements, as well as the mode of making large circular-saws of many pieces.† Mr. Smart also contrived a series of sawing machines for making canteens, cutting tenons, &c.

After the completion of the block machinery it becomes very difficult to trace the subsequent improvements. The art of machine-making for working in metal was gradually advancing, but is not recorded in patents, and very little described in books. The slide-rest principle was extended, large self-acting lathes constructed, and boring-machines of great precision and improving structure were called into existence by the necessity for extreme accuracy in the cylinders of steam engines. The best engravings of the machines of this period are in "Rees' Cyclopædia," and in the volumes of the "Transactions" of the Society of Arts.

No greater proof of the obscurity which hangs over the history of machine tool-making, in the first half of this century, can be given than the unknown origin of the planing-machine for metal. The machine which Nicolas Focq contrived in 1751, which has been called a planing-machine, has no title to the name, or any resemblance to the modern engine. It is nothing but a heavy scraping tool, which is dragged along the bar upon which it is to operate, and rests upon it, pressed into hard contact with it by strong springs. It will, therefore, smooth the surface, and remove small irregularities, as a carpenter's plane does with a board; but it will not produce a correct plane surface, or even make successive cuts. It is a mere *plane*, and not a *plane-creating engine*. Neither could the machines patented by Bentham in 1791, and Bramah in 1802, for planing wood, although real planing-engines, have suggested the engine in question, for their properties and arrangements are wholly different. The engineers' planing-machine made its way into the engineering world silently and unnoticed; and some years afterwards, when its utility became recognised and men began to inquire into its history, various claimants to the honour of its invention were put forward. We can only learn that, somewhere about 1820, or 1821, a machine of this kind was made by several engineers. Messrs. Fox, of Derby, and Roberts, of Manchester, appear amongst the number, and the forms which they gave to the engine have remained permanent. Mr. Clement has also been mentioned, as well as others. It is clear that the inventors were not at all aware of the immense importance of their work, but experience has proved the utility of this machine to be so great that it may be pronounced the greatest boon to constructive mechanism since the invention of the lathe. Nevertheless, no drawing or description of the planing-engine is to be found in any English book until 1833, when the Society of Arts published beautiful engravings of Mr. Clement's machine. The complexity of this, and the unfortunate arrangement of the bed, which he mounted on wheels, has prevented it from being adopted. The French and other continental mechanical journals, much earlier began to give engravings and descriptions of the English planing-machine. In 1829 the *Industriel* has one of the simplest, and the Bulletin of the "Société d'Encouragement," the collections of Le Blanc, Armengaud, and others, contain engravings not only of the planing-machines, but of the other machine tools of all our best English makers, generally accompanied by admirable descriptions and minute details that may well serve as models to our own writers on such subjects, and at the same time show how much good service is rendered by the superior mathematical and theoretical education of French engineers. Be it remembered, too, that, not content with describing and analysing our machine tools, which they do in a most liberal and admiring spirit, they also employ their generalising powers in the endeavour to construct improved forms, and with such great promise of success that, unless we also begin to apply science to this subject, we run considerable risk of falling behind our ingenious neighbours.

The mortising-engine of the block machinery was applied by Mr. Roberts, of Manchester, to the formation of the key-ways of cast-iron wheels, and also to the paring, or planing by short strokes, of the sides of small curvilinear pieces of metal, such as cams, short levers, and other pieces that do not admit of being finished in the lathe. Thus, under the name of *slotting and paring machine*, a new and generally useful machine tool sprang up; and subsequently another, derived from it, has been produced, and apparently with equal success, under the title of a *shaping machine*. It is, in fact, a planing-machine, in which the tool is attached to the end of a horizontal bar, which is moved to and fro, so as to

* 1793. "Repertory," vol. x., p. 393.
† Patent, 1802.

plane, with short transverse strokes, a piece of work fixed on a complex adjusting-bed, or on a revolving mandrel, so as to receive the action of the tool.

The existence of such principles lead us to the hope that machines much more comprehensive, and yet simpler in form, will be devised for the same purposes, by means of which the construction of machinery in general will attain to greater perfection, and machine-tools be introduced into workshops of a smaller character than at present, in the same manner as the lathe.

In America, a variety of contrivances are employed in workshops to facilitate and give precision to ordinary operations: as, for example, the foot-mortising machine for wood. The earliest contrivance of this useful tool (the offspring of Bentham's mortising-engine) appears to be in a Pennsylvanian patent by John M'Clintie, in 1827,* since which the machine has got into general use in America, and has consequently been the subject of numerous patents for minor arrangements. One of these, by Page, was engraved in the Mechanics' Magazine (1836, vol. xxvi., p. 385), and thus introduced to English workmen; and in the last year Mr. Furness, of Liverpool, has patented some improvements in England, and endeavoured to introduce the machine. It formed a very interesting object in the Exhibition, together with other American contrivances for boring, tenoning, and such like operations, which the peculiar conditions of that country have called into existence, by creating a market for them.

In reviewing the comparatively slow progress of machine tool making, it will appear that in this, as in other branches, steps in invention that, when once made, appear exceedingly simple and obvious, are often the most difficult to take. The chance that such steps will be made is increased by bringing to bear upon them the greatest number of heads; for the peculiar faculties or acquirements of one man, or set of men, may serve to carry on an invention to a certain point at which it is prepared for, and requires those of another set of men who may carry it further. In the old time, the exceeding secrecy and jealous care with which every new contrivance was guarded and watched, retarded the advance of machinery to an extent that we can hardly believe. Each man was working in ignorance of his neighbours' improvements, and every art was indeed a mystery. And not only did these difficulties obstruct the progress of machinery, but led to the enormous expense of constructing new machines. We know that the art of construction has undergone a complete revolution since the block-machinery was made, but we can scarcely estimate the prodigious amount of labour and thought that was required to give existence to that machinery, which, indeed, could never have been effected without the resources of the nation in the then imperfect state of the art. To these retarding causes must be added the jealousies of workmen and their dislike of new methods.

I have already alluded to the advantage of promoting a more universal knowledge of each other's methods amongst the mechanists of different branches and countries. A very interesting part of the Great Exhibition was the collection of strange-looking tools from France, Germany, and elsewhere, differing in their forms and handles and mode of operation from those employed for the same purposes by our own workmen. Without doubt some of them might afford useful hints; for example, the universal employment of the narrow frame-saw on the continent for work that we perform with broad-bladed saws, stiffened with brass or iron backs, might lead our workmen to consider whether, after all, our practice is not carried too far in this respect.

But the facilities for working in metal, and its general introduction into all kinds of frame-work where wood was exclusively employed, as well as the substitution of cast-iron for brass, has made it imperative upon persons of all trades which are affected by these changes, to learn the management of these new materials, if they desire to profit by the advantages consequent upon their employment. Thus, the philosophical instrument-makers formerly employed brass for their metal work, and constructed their machines, even the largest astronomical instruments, in a great number of pieces screwed together. We have now learnt that stability is best insured by employing fewer pieces, and that cast iron is on all grounds a better material than brass. But the tools and methods of working in cast iron are wholly different, and therefore the philosophical instrument-makers must turn engineers, and employ planing-machines and the like. The making of large clocks, and various other articles of common use, must undergo the same change. It is useless to state that these men can go to an engineer's shop to get jobs done for them as required. Such a method can only lead to a partial and imperfect employment of the new resources and advantages which are to be developed. For instead of a full and complete adoption of these novelties, the use of

* "Journal of the Franklin Institute," vol. vi., pp. 10 and 168.

them will be necessarily evaded in every case where they can be dispensed with, unless the master-workman can employ them freely as his own.

In machinery we have to deal with every kind of material, and to avail ourselves of the peculiar properties of all in their appropriate places; and thus a skilful engineer should be familiar with every kind of mechanical manipulation and material, from a sheet of card-paper to an iron bar, and ought to know as well how to hem a pocket-handkerchief as to rivet a boiler. It is of no use for him to employ workmen of any trade in carrying out new combinations, unless he himself know how to instruct them. A musician who is about to compose a symphony need not be able to play on the violin like Paganini, or on the piano like Thalberg; but he must be well acquainted with the powers and manipulation of these and every other instrument before he can write passages that will bring out their effects and be adapted to performance. And, in the same way, a man who intends to devise and carry out a new machine must be conversant with the peculiar properties and mode of manipulating every kind of material, that thus he may select and avail himself of them to the best advantage.

MANUFACTURING INDUSTRY DURING THE LAST AND PRESENT CENTURY.

[From a Lecture delivered at the Manchester Mechanics' Institution by Wm. Fairbairn, Esq., C.E.]

If we take—I will not say a statistical—but a very cursory view of the recent position of Manchester and the surrounding districts, and compare it with what it was at the close of the last and the commencement of the present century, we shall find that at that period the useful and industrial arts were comparatively of little importance. We shall also find that the gems of a new and, above all others, an important branch of manufacturing industry were springing into existence. I have no returns of the state of our manufacturing industry at that period, but the writings of one of our earliest and most intelligent spinners, to whom this country is indebted for many improvements in machinery—Mr. John Kennedy—informs us that the spinning of cotton yarn antecedent to the year 1768 was of an exceedingly limited description. That gentleman, in his account of the rise and progress of the cotton trade, states that the hand-loom, as a machine, remained stationary for a great number of years, without any attempt at improvements until 1750, when Mr. John Kay, of Bolton, first introduced the fly-shuttle—and that the spinning of cotton yarn from that period, and for many years previous, was almost entirely performed by the family of the manufacturer, at his own house. This united and simple process went on till it was found necessary to divide their labours, and to separate the weaving from the spinning, and that, again, from the carding and other preparatory processes. This division of labour, as Mr. Kennedy truly says, led to improvements in the carding and spinning "by first introducing simple improvements in the hand instruments with which they performed these operations, till at length they arrived at a machine which, though rude and ill-constructed, enabled them considerably to increase their produce." Thus it was that improvements and the division of labour first led to the factory system, and that splendid and extensive process which at the present moment, and for many years to come, will affect the destinies of nations. From 1750 to 1770, when Mr. Hargreaves, of Blackburn, first introduced his spinning jenny (by means of which a young person could work from ten to twenty spindles instead of one), there was little or no change; but a very material alteration took place shortly after the introduction of these improvements, which were immediately followed by Mr. Arkwright's machinery for carding and roving. These, accompanied by the introduction of Mr. Crompton's mule, in 1780, may be justly considered to constitute the origin of the factory system, which has now grown to such colossal dimensions as to render it one of the most important and most extensive systems of manufacture ever known in the history of ancient or modern times. "Mr. Arkwright built his first mill at Cromford, in Derbyshire—(I again quote from Mr. Kennedy)—in 1771. It was driven by water; but it was not till 1790, or some time after, when the steam engine of Watt came into use, that the cotton trade advanced at such an accelerated speed as to render its increase and present magnitude almost beyond conception. This immense extension is not only a subject of deep interest to the philosopher and statesman, but one which is likely to furnish a large field of observation for the future historian of his country." I will not trouble you with the statistics of the cotton trade, as it now exists, but simply observe—as many of you are doubtless better informed on this subject than myself—that I am within the mark when I state that not less than 31,500 bales of cotton are consumed weekly in the two kingdoms, England and Scotland; that nearly 21,000,000 spindles are almost constantly in motion, spinning upwards of 105,000,000 hanks, or 50,000,000 miles of

yarn per day—in length sufficient to circumscribe the globe 2,000 times. Out of this immense production, about 131,000,000 of pounds of yarn are exported; the remainder is converted into cloth, lace, and other textile fabrics. This marvellous increase, this immense extent of production, could not be effected without considerable changes in the prospects of the moral, as well as the physical, condition of society. It has entirely changed the position of the resident population of the district, and the secluded valleys, farm-houses, and neat cottages—the beauties of a Lancashire landscape of the last generation—are rapidly giving way to the conversion of villages into populous towns, with innumerable erections, which resound with the busy hum of the spindle and the shuttle. Along with these changes we see a new generation springing into existence—factories, steam engines, and tall chimneys rising in every direction, and the noise and smoke which meet the eye and the ear of the stranger at every step, give evidence of the activity and prosperity of the industrious hive, which at some future time in English history will announce to succeeding generations the inventions and the discoveries of the nineteenth century.

In this attempt to place before you a short account of the use and progress of our national industry, I must not forget that yarn, however finely and dexterously spun, is not cloth; and here we enter upon another and equally ingenious process. The yarn must be woven before it is fit for use; and we shall find weaving one of the most interesting as well as elaborate operations of the useful arts. I need not inform you the ancient Hindoos, Egyptians, and probably the early Chinese, converted their yarn into cloth. The Indian and Oriental department of the Great Exhibition exhibited the mode and primitive character of their looms and other implements, which have been handed down from generation to generation from the earliest periods, without change or improvement, till the present day. Looms of this rude construction were introduced into Europe during the first glimpses of civilization, and for many centuries even the most advanced nations were content to use the same instruments, almost without improvement, until the introduction of the flying shuttle, and the subsequent invention of Hall and Arkwright opened a new and untrodden field for improvements in every department of art and manufacture. Power-looms at that period were unknown, and although attempts were made by Mr. Cartwright, as early as 1774, to convert the hand-loom into a machine to be moved by power, it was not until the beginning of the present century that the power-loom assumed its present form, and presented that intelligence of structure which rendered it self-acting, and enabled it to compete with the hand-loom weaver. From that time (about 1810 or 1812) we may date the commencement of that increase to which that important branch of our manufacture was extended. The improvements introduced by Mr. Bennet Woodcroft, and others, for weaving twills and similar fabrics, created new expedients and applications, and greatly increased the demand for this description of manufactures; whilst the inventions of Jacquard for weaving figured cloth startled every one with their extreme ingenuity and beauty, and accomplished the perfection of machinery for the production of textile fabrics. The increase and extent of cloth manufactured from power-looms may be estimated from official returns kindly furnished me by Mr. Leonard Horner. There are now at work in the United Kingdom above 250,000 power-looms. Now, as each loom will, upon the average, produce from five to six pieces of cloth per week, each piece 28 yards long,—say 25 yards a day per loom,—we have 250,000, which, multiplied by 25, gives 6,250,000 yards, or 3,551 English miles, of cloth per day; the distance between Liverpool and New York. Only think of the importance and extent of a manufacture that employs upwards of 12,000 hands in weaving alone, supplying from that source (the power-loom) an annual produce of cloth that would extend over a surface, in a direct line, of upwards of 1,000,000 miles.

But although much has been done, much has yet to be accomplished before the supply equals the demand. It must appear obvious to those who have studied and watched the unwearied invention and continued advancement which have signalised the exertions of our engineering and mechanical industry. But neither difficulties nor danger, however formidable, can stand against the indomitable spirit, skill, and perseverance of the English engineer; nor will it be denied that the ingenuity and never-failing resources of our mechanical population are not only the sinews of our manufacture, railways, and steam-boats, but the pride and glory of our own country. It is for this important class that I have ventured to address you, and I trust the time is not far distant when we shall witness establishments suitable for their education; such as will teach them to reason and to think, and to impart that knowledge essential to a more correct acquaintance with physical truth, and a clearer conception of the varied manipulation of those arts in which consist the true interests of the country.

The Application of Self-acting Machines to the Construction of Machinery.—It is nearly half a century since I first became acquainted with the engineering profession, and at that time the greater part of our mechanical operations were done by hand. On my first entrance into Manchester there were no self-acting tools; and the whole stock of an engineering or machine establishment might be summed up in a few ill-constructed lathes, a few drills and boring machines of rude construction. Now compare any of the present works with what they were in those days, and you will find a revolution of so extraordinary a character, as to appear to those acquainted with the subject as scarcely entitled to credit. The change thus effected, and the improvements introduced into our constructive machinery, are of the highest importance; and it gives me pleasure to add, that they chiefly belong to Manchester, are of Manchester growth, and from Manchester they have had their origin. It may be interesting to know something of the art of tool making, and of the discoveries and progress of machines, which have contributed so largely to multiply the manufactures, as well as the construction of other machines employed in practical mechanics. In Manchester the art of calico printing was in its infancy forty years ago; the flat press, and one, or at the most two, coloured machines were all that were then in use; the number of those machines is now greatly multiplied, and I believe some of them are capable of printing eight colours at once; and the art of bleaching, dyeing, and finishing have undergone equal extension and improvement. In the manufacture of steam-engines there were only three or four establishments that could make them, and those were Bolton and Watt, of Soho; Fenton, Murray, and Wood, of Leeds; and Messrs. Sherratts, of this town. The engines of that day ranged from three up to 50, or at most 70 horses' power; now they are made as high as 500, or in pairs from 1,000 to 1,200 horse. An order for a single engine at that time was considered a great work, and frequently took ten or twelve months to execute; now they are made by dozens, and that with a degree of despatch as to render it no uncommon occurrence to see five or six engines of considerable power leave a single establishment in a month. In machine-making the same powers of production are apparent. In this department we find the same activity, the same certainty of action, and greatly increased production in the manufacture of the smaller machines, than can possibly be attained in the larger and heavier description of work. The self-acting, turning, planing, grooving, and slotting machines have afforded so much accuracy and facility for construction as enable the mechanical practitioner to turn, bore, and shape with a degree of certainty almost amounting to mathematical precision. The mechanical operations of the present day could not have been accomplished at any cost thirty years ago, and what was considered impossible at that time is now performed with a degree of intelligence and exactitude that never fail to accomplish the end in view, and reduce the most obdurate mass to the required consistency, in all those forms so strikingly exemplified in the workshops of engineers and machinists. To the intelligent and observant stranger who visits these establishments, the first thing that strikes his attention is the mechanism of the self-acting tools; the ease with which they cut the hardest iron and steel, and the mathematical accuracy with which all the parts of a machine are brought into shape. When these implements are carefully examined, it ceases to be a wonder that our steam-engines and machines are so beautifully and correctly executed. We perceive the most curious and ingenious contrivances adapted to every purpose, and machinery which only require the attendance of a boy to supply the material and to apply the power, which is always at hand. In conclusion, I would observe that it is an honour to this country that we stand at the head of the engineering and mechanical profession. It is an art—I would call it a science—which has occupied the attention of the greatest men from the days of Newton and Galileo, down to those of Watt and Smeaton, and it now receives attentive consideration from some of the ablest and most distinguished men of the present time. And of these I may instance Poncelet, Morni, Humboldt, Brewster, Babbage, Dr. Robinson (of Armagh), Willis, and many others, to show the interest that is taken by these great men with the advancement of mechanical science. A great deal has been done, but a great deal more may yet be accomplished, if by suitable instruction we carefully store the minds of our foremen and operatives with useful knowledge, and afford them these opportunities essential to its acquisition. We must try to unite theory with practice, and bring the philosopher into close contact with the practical mechanic. We must try to remove prejudices, and to encourage a sounder system of management in the manufactures, design, and projects of the useful arts. When this is accomplished we shall no longer witness abortions in construction, but a carefully, well-digested system of operations founded on the unerring laws of physical truth.

DIAMOND TESTS.

Professor Tennant, of King's College, in a recent lecture at the Society of Arts on stones, furnishes some valuable information on the means of distinguishing artificial stones from real ones, and of discriminating between a precious stone of one kind and another. He explained that there were certain physical characters belonging to all minerals, such as the crystalline form, fracture, hardness, lustre, colour, double refraction, electricity, and specific gravity. This latter character he strongly recommended persons to make themselves well acquainted with, as a safe and easy mode of ascertaining the different species of polished gems, rather than the common and dangerous method of testing them by a file, he having known several instances where valuable stones had been very seriously injured by the latter process; diamonds, for instance, having been broken in the direction of the cleavage planes. Mr. Tennant next described the crystallised forms of the diamond, and pointed to a diagram illustrating the modifications of the octohedron, dodecahedron, cube, &c., which are the usual crystalline forms of that substance; *it is never found as a six-sided prism*. Had this been known, the incident which he was about to relate would not have occurred:—A person was offered 200*l*. for a stone (which the lecturer exhibited) that he had picked up in California, under the impression that it was a diamond; and the possessor of it, being of the same opinion, refused to part with it for that sum. It was a six-sided prism, terminating in a pyramid at each end. Neither of them knew that diamonds never assume that form; and, accordingly, 200*l*. was offered by one, and refused by the other, for a stone that was only a piece of crystallised quartz, not worth more than half-a-crown. Perhaps some of his audience recollected a beautiful blue stone that was labelled "Phenakite" in the Russian department of the Exhibition: much doubt was at first entertained of its nature. One one occasion several gentlemen were brought together to examine it. Almost every one present gave a different opinion as to the real nature of the stone, only one called it by what turned out to be its real name. The Professor suggested that the simplest and safest test would be to ascertain its specific gravity, which was done as follows:—he first weighed the stone in air, when its weight was 562 grains; he then immersed it in water, when its weight was 404 grains. He then divided the first weight by the difference, or 158 grains, and the result was 3·5 grains, which is the specific gravity of topaz. He was the more particular in dwelling upon this matter because he was satisfied that both in California and Australia, where they were so intent on searching for gold, they were in many cases flinging diamonds away.

THE NEW PATENT LAW AMENDMENT BILL.

The following is a summary of the clauses in the Bill recently brought in by Lord Colchester:—

1. Constitution of Commissioners, of whom Three may act, the Lord Chancellor or Master of the Rolls being One.
2. Seal of the Commissioners.
3. Commissioners to appoint Examiners, make Rules and Regulations, which shall be laid before Parliament, and report annually to Parliament.
4. Treasury to provide Offices.
5. Treasury to appoint Officers, except such as the Commissioners are authorised to appoint.
6. Petition and declaration to be accompanied with a Provisional Specification.
7. Every application to be referred to One of the Law-officers.
8. The Provisional Specification to be referred to Examiners and invention provisionally protected from the Day of presenting Petition.
9. Provision for Inventions registered under the Protection of Inventions Act.
10. Inventor may deposit, in lieu of a Provisional Specification, a complete Specification, such Deposit to confer for a limited Time the like Rights as Letters Patent.
11. Letters Patent granted to the First Inventor not to be invalidated by Protection obtained in Fraud.
12. Commissioners to advertise Protection.
13. Application for Letters Patent to be advertised, and Examiners to report on Invention to Law-officer.
14. Law-officer to refer Specification and Objections to an Examiner for his Report.
15. Appeal to Law-officer and Power to give Costs.
16. Warrant of Law-officer for sealing of Patent. Writ of Scire Facias.
17. Saving of the Royal Prerogative.
18. Letters Patent to be made subject to Avoidance on Non-fulfilment of certain Conditions.
19. Letters Patent for the whole of the United Kingdom, the Channel Islands, the Isle of Man and the Colonies, to be issued under the Great Seal.
20. Letters Patent not to be issued after Three Months from Date of Warrant.
21. Letters Patent not to be issued after the Expiration of Protection given by this Act.
22. If Letters Patent be destroyed or lost, other Letters Patent may be issued.

23. Letters Patent may be dated as of the Day of the Application.

24. Letters Patent where ante-dated to be of the same validity as if sealed on the Day of the Date.

25. Use of Invention abroad to have the like effect on Letters Patent as use or Publication in the United Kingdom.*

26. Specifications to be required to be filed in the Office of the Commissioners.

27. Specifications and Drawings to be filed; extra Copies of Drawings to be left.

28. Copies of Specifications to be open to Inspection.

29. Specifications and other Documents to printed and published.

30. Enrolments, &c., may be removed to the Office of the Commissioners.

31. Commissioners to cause Indices to be made to Old Specifications, &c., such Specifications, &c., may be printed, and published.

32. Printed Copies to be Evidence.

33. Register of Patents to be kept.

34. Register of Proprietors to be kept.

35. Falsification or Forgery of Entries in Register of Proprietors a Misdemeanor.

36. Entries may be expunged and varied.

37. Provisions of 5 and 6 W. 4. c. 83., 7 and 8 Vict. c. 69., as to Disclaimers and Memoranda of Alterations, to apply to Patents under this Act. Applications for Disclaimers and Caveats relating thereto to be lodged at Office of Commissioners.

38. Provisions of 5 and 6 W. 4. c. 83., 2 and 3 Vic. c. 67., 7 and 8 Vic. c. 69., as to Confirmation and Prolongation, to apply to Patents under this Act.

39. In Actions for Infringement of Letters Patent, particulars of the breaches, and of grounds of invalidity, to be delivered, and no evidence allowed not mentioned therein.

40. Courts of Common Law may grant Injunction in case of Infringement.

41. Particulars to be regarded in Taxation of Costs.

42. Payments and Stamp Duties on Letters Patent to be as in Schedule.

43. Duties to be under Management of Commissioners of Inland Revenue.

44. All Monies received to be paid into Consolidated Fund.

45. Nothing in this Act to prevent Payment of Fees to Law-officers in cases of Appeal, &c.

46. Fees and Salaries of Officers.

47. Sums for defraying Salaries and Expenses under this Act to be paid out of Monies to be provided by Parliament.

48. Providing for Compensation of Persons affected by this Act.

* On this subject see the able letter of Dr. Normandy in another part of our present Number.

49. Account of Salaries, Fees, and Compensation allowances to be laid before Parliament.

50. Act not to extend to Letters Patent on Applications before passing of this Act.

51. Letters Patent for England, Scotland, or Ireland.

52. Forms in Schedule may be used.

53. Interpretation of Terms.

54. Short Title of Act.

[The Schedule of Fees and Stamp Duties is the same as that to the Government Bill of last Session, which we have already given, (see p. 117, vol. lv.)]

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING APRIL 8, 1852.

James Warren, of Montague-place, Mile End-road. *For improvements applicable to railways and railway carriages, and improvements in paving.* Patent dated October 2, 1851.

Claims.—1. Several forms of sleepers. (The principle adopted in all is that of making the sleeper in the form of a prism, with feathers or strengthening pieces transversely.)

2. The application of a bridge rib on the same, for better seating the lower flange of the rail.

3. The perforating or grating the sides of sleepers to effect drainage.

4. A peculiar form of chair, by which the use of reefs is dispensed with.

5. A clip chair, which tightens on the rail by passing traffic.

6. A peculiar form of joint clip (for connecting the ends of rails together.)

7. An elastic locking buffer (which consists of a wedge-formed buffer taking into a suitably-formed counterpart constructed of springs.)

8. A sledge-van to be used as a break (by being lowered on the rails when it is desired to stop the train.)

9. The adaptation of pumps to an ordinary locomotive engine, so as to convert it into a fire-engine. (When in use, the engine will be raised above the rails so as to permit of the wheels revolving freely, and of all the power being applied to the working of the pumps.)

10. The use of a wheel acted on by the wheels of a train of carriages, or an engine, or by a sledge attached to the last carriage, of a moveable rail opened by the same means, and of a jointed rail depressed by the same means, or by a cam attached to the last carriage for the purpose of exhibiting signals on railways, and the general arrangements described for that purpose.

11. The use of a wheel acted on by the flanges of the wheels of a train of carriages or an engine, or by a sledge or cam attached to any of the carriages, of a cam acted on by the same means, of a sliding rail, and of a jointed rail acted on by the same means, for the purpose, with the intervention of suitable mechanical arrangements, of ringing a bell, striking a gong, or discharging detonating compounds.

12. The application of a self-acting break hinged or jointed to the back frame of railway carriages (to prevent slipping or retardation in ascending inclines.)

13. The use of jointed rails, or of a sliding rail acted on by cams or rollers attached to the engine-framing, to open or shut the points or switches of a railway (and thus render the attendance of a switchman unnecessary.)

14. A peculiar form of sledge-break, with counterweights (for gradually stopping a train of carriages.)

15. The use in pavement of pegs of wood, iron, or other material, resting on or inserted in, or attached to an iron bed-plate, in conjunction with suitable material to fill in between, but not the use of the materials without the pegs. (The materials employed are broken granite and other stone rammed in between the pegs, or grouted in with asphalte.)

16. The application of the pegs to form designs or letters on the surface of the pavement.

Thomas Cussons, of Bunhill-row. *For improvements in ornamenting woven fabrics for bookbinding.* Patent dated October 2, 1851.

These improvements consist in applying the process of marbling to the ornamenting woven fabrics. The fabrics which the patentee prefers to employ are those which have been stiffened and glazed by pressure or otherwise, but the fabrics may also be used in an unstiffened state. The process of marbling is performed in precisely the same manner as when paper is used, and the workman prepares his trough of liquid and lays the colours thereon, as when operating on paper. He then applies the woven fabric to the floating colours with the glazed side downwards, and afterwards raises the fabric and dries the same. When it is finished by glazing, or if the pressure necessary for this operation would prove injurious to the pattern, the fabric is sized instead. In order to give diversity to the effect produced on the marble side of the paper, the workman may use a rake or comb, as is well understood in the trade, or he may use a bar with points projecting downwards; by introducing which; into the floating colours and moving the same along, a curled effect will be produced in the marbling. In conclusion, the patentee observes, that the novelty of this invention consists in applying the process of marbling to woven fabrics.

William Henry Ritchie, of Kennington, gentleman. *For improvements in ornamenting glass.* (A communication.) Patent dated October 2, 1851.

The method usually adopted, when ornamenting glass with enamel, has been to spread the enamel over the surface of the glass in a semi-fluid state, and, when dry, to remove or scrape off portions therefrom according to the design or pattern to be produced. And sometimes lace, or other open or reticulated fabric, has been employed to produce a pattern or design—the enamel in such case being applied to those portions of the glass which are left uncovered by the substantive parts of the lace or reticulated fabric used.

According to the method sought to be secured by the present patent, lace or other reticulated or perforated fabric is also employed, but in a different manner from what it has been heretofore. In this process, then, the glass is first covered, as in the ordinary method, with semi-fluid enamel, white or coloured, which is allowed to dry, and when dry a piece of lace, stretched in a frame, is placed in contact with the enamel-covered surface, and kept pressed down by weights, and, with a soft brush, those parts of the surface which are left uncovered by the openings or perforations in the lace or other reticulate material, have the enamel removed from them, after which the lace is raised from contact with the glass, and the glass is submitted to heat, so as to fuse and fix the enamel, and subsequently annealed in the manner ordinarily practised. The same method of procedure will also be followed when perforated paper or other material than lace is used for producing in enamel ornamental patterns on glass.

Claim.—The mode described of ornamenting glass, whereby lace and other perforated or reticulated fabrics or materials are used when removing parts of the enamel or ornamenting material from the glass.

William Hodge, of St. Austell, Cornwall. *For improvements in the manufacture of glass, china, procelain, earthenware, and artificial stone.* Patent dated October 2. 1851.

Mr. Hodge's improvements consist in the employment in the above-stated manufactures of the material known as hornstone porphyry, otherwise called elvan or freestone, which has never hitherto been used for the purpose.

For the manufacture of glass, the elvan is to be reduced to powder, and to be mixed

with the other pulverised materials in the melting-pot; and as the constituents of elvan are silex in combination with potash and alum in different proportions, it will be found a material well adapted for glass making. The proportion of elvan employed will vary according to the quality of glass to be produced, and the nature of the material will determine the quantity of fluor spar, lead, potash, or other flux, for fusing the same. Thus, when the proportion of silex is large, an increased quantity of fluor spar will be required, and so with other fluxes. The elvan does not generally for this use require to be washed after being pulverised, but it may sometimes be found necessary to submit it to this operation.

For the manufacture of china, porcelain, and earthenware, the elvan is reduced to powder, and brought to a plastic state, when it is moulded in the usual way, and then dried and fired as customary. The elvan may be used alone, or may be combined with china clay, or such other materials as are commonly used in earthenware or china manufacturing; and according to the quantity in which it is used, so will the character of the manufactured article more or less resemble that of stone-ware. The elvan may also be used for making glazes in the same manner as other materials are now employed for the same purpose.

For producing artificial stone, the elvan may be used alone or in combination with granite or other similar stone or substance in broken fragments, or reduced to a powdery condition. The materials having been mixed together, are brought to a plastic condition, moulded into blocks, dried and fired in the usual way.

Although in the manufacture of articles of china, porcelain, and earthenware, the elvan is above directed to be powdered and brought to a plastic condition, and moulded into the form of article to be produced, it is nevertheless capable of being worked in a pulverised or disintegrated condition, and applied to the manufacture of articles by dies and pressure, the method of doing which is well understood.

Claim.—The application of hornstone porphyry, otherwise called elvan or freestone, to the manufacture of glass, china, porcelain, earthenware, and artificial stone.

LEMAN BAKER PITCHER, of Syracuse, New York, United States, gentleman. *For improvements in machinery for regulating motive-power engines.* Patent dated October 2, 1851.

Claims.—1. The general arrangement of apparatus described for regulating motive-power engines.

2. Applying the motion communicated to a plunger by a force-pump to actuate the cut-off valves of steam and other motive-power engines.

3. Actuating the valve which governs the supply of steam or other motive-power agent to the engine to be regulated by means of adjustable tappets having a reciprocating motion.

4. A peculiar mode of mounting and adjusting disc-valves.

ETIENNE ALEXANDRE ARMAND, of Paris. *For improvements in the mode of distilling and treating organic substances and bituminous matters, and in the treatment of their products, together with the apparatus used for the said purposes.* Patent dated December 19, 1851.

It is well known that when organic substances, such as wood, coal, fats, gum resins, horns, hides, and animal waste of all sorts, are heated in a closed vessel, decomposition ensues with the production of volatile bodies, which are sublimed, and of a solid residuum, which remains in the vessel: the same also occurs when bituminous ore is used—the residuum in this case, however, being the sandy or earthy substance which served as the basis of the ore, while, in the former case, it is charcoal more or less pure. The other products of this distillation are of various kinds; namely gas and vapours, which are condensed into vinegar, water, essences, coal-tar, &c., and the proportions in which they are obtained will, of course, vary with the nature of the substances operated on.

Attention has been directed, in different trades, to the best modes of collecting increased proportions of certain of these products at the expense of the others; thus the vinegar manufacturers use wood, which they distil at a low temperature, while gas-maker use coal at a high temperature, in order to obtain as large a proportion of gas as possible without producing ammonia or coal-tar. Sometimes it is an object to produce oil and bituminous matters, and for this purpose bituminous ores, resinous substances, and the inferior descriptions of coal-tar, are used. The invention of the patentee relates to the distilling of these substances, and is founded on the consideration that the elements of the gas and tar being the same, it is possible to obtain the one from the other; that is, gas from tar, and from gas in contact with tar a liquid product rich in hydrogen, which, by dissolving in the tar, modifies its character. In this new system of working, the volatilized gases, instead of being condensed as usual, are made to pass through boiling tar, or hydrocarbonaceous matter, so as to obtain a reduced quantity of gas, and a new product by the absorption of part of the gas in the tar or tar-oil used.

The distillation of the bituminous matters is conducted as follows:—The matters are

placed in cases, which are introduced into two or more open-ended retorts placed side by side in the same furnace. At both ends of the retorts are provided condensing apparatus, divided into three compartments, each containing pyrogenic oil of a specific gravity 0·90 to 9·96, which, during the working of the apparatus, is raised to different degrees of heat, and through which successively the gases, on escaping from the retorts, are caused to pass, so that portions are condensed therein, while the uncondensable gases are conducted away to a gasometer for being burnt or otherwise used. The condensing apparatus being so contrived that it shall be of different degrees of heat in the different compartments, the products contained in them will be found to be of various densities—the lighter and most volatile being in that part of the condensing apparatus where the temperature is lowest, and the heavier products being in that where the heat is more directly applied. When the nature of the working will not admit of the above apparatus being used—as, for instance, in manufacturing coke—the gases may be caused to traverse a vertical shaft full of pebbles, through or among which the hot oil is caused to trickle. The products obtained by this operation would be treated the same as those from the process just described.

For the purpose of purifying and decolorizing the light oils thus obtained, the patentee adds to them about 1 per cent. of nitrous sulphuric acid, which is poured gradually in, so as to prevent heating of the mixture, the oil being kept the while in a state of agitation. After a short time the oil clears itself, and the colouring matter is deposited; the oil is then decanted, and washed, first with lime-water, and afterwards with water alone, after which it is distilled in combination with a concentrated saline solution (composed of equal weights of an alkaline chloride and nitrate, such as sea-salt and saltpetre), in order to absorb any sulphurous acid that may still remain in it, and to produce steam, by which the distilling operation is found to be facilitated. For the purpose of conducting this process, the patentee makes use of a modification of the calcining apparatus before mentioned. Instead of using nitrous sulphuric acid for rectifying the light oil, concentrated sulphuric acid, with peroxide of manganese, may be employed, or acid and permanganate, or chromate of potash, or any suitable oxidizing body. Instead also of the above-mentioned saline solution, a melted mixture of anhydrous lime and potash may be substituted, and the oil caused to come in contact with the same, which is well adapted for combining with any sulphurous acid and clearing the oils.

The heavy oils are treated by mixing them with about 1 per cent. of nitrous sulphuric acid, or of the above oxidising mixtures, and allowing them to stand for a short time. The liquor is then decanted, and washed repeatedly with warm lime-water, after which the oil is mixed with about 3-7ths by weight of fixed oil, such as rape oil, &c., with the addition of about 2 per cent. of the oxidising mixture. The whole is then agitated until it becomes of a rich violet colour The patentee now again uses weak lime solution, or steam, which precipitates the sulphurous acid, and he filters the liquid, when the oil will be found to have become of a yellow colour, and perfectly transparent. The separation of the acid is a slow process, and to effect it perfectly it is necessary to wash repeatedly, and allow the mixture to stand two or three days after each washing. Another process for treating these heavy oils is as follows:—The patentee mixes the fixed oils after the second addition of oxidizing matter, and he then decants the liquor, washes it with slightly alkalized water, and places it in a sand-bath heated to about 390° Fahr. for about six hours.

The heaviest oil may, without any preparation, be used as a grease for machinery and carriages, or it may be distilled to any required degree of concentration. A solid grease may be produced by mixing the heaviest oil with about 10 per cent. of resin or of a fixed oil or fat, and treating the mixture with a solution of lime and potash, or lime and soda, at a heat of 212° Fahr., and agitating continually until the mixture becomes mixed. When cold, the compound grease is of a brown colour, and fit for greasing carts or railway carriages.

Claims.—1. A mode of calcining or distilling solid organic substances or bituminous matters, by placing the same in earthenware or metal cases, and introducing the cases into the retorts instead of placing the substances directly into the retorts.

2. A mode of collecting the volatile products from the calcination, by which the said products are made to pass through hot pyrogenic oil, whereby a part of the uncondensable gas is transformed into condensable vapours, and those vapours are condensed into liquids of different densities by passing through vases differently heated.

3. The several described methods of treating the light oils, heavy oils, and bituminous matters by means of the specified chemical processes when working the apparatus described.

4. A mode of distilling any kind of liquid organic substance and bituminous matter,

similar to that claimed for dry substances, but with this difference, that instead of placing inside the retorts open cases containing the solid substance, a closed case inside the retort, with suitable openings, is employed, the said case being connected by any suitable providing contrivance, such as described, with the vessel containing the liquid substances, which is preferred to be placed outside the retort; and further, a particular contrivance for heating the liquid substance on its way from the reservoir in the case.

The use of a closed case with side openings, such as used for distilling liquid substances, may be preferable to open cases for the working of bituminous or asphaltic solid ore. In treating such, the patentee adds about 10 per cent. of light oil, and heats the retort to 390°. The oil dissolves the bituminous matter, and vapours are formed, and the liquid forced from the cases into receivers, where it is concentrated. When no more liquid comes over, the case is withdrawn, and will be found to contain only the earthy basis of the ore.

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Earnshaw Cooper, of Mottram, Chester, tallow-chandler, for certain improvements in the manufacture of candles and candle-wicks, and in the machinery or apparatus employed therein. April 2; six months.

Joseph Pimlott Oates, of Lichfield, Stafford, surgeon, for certain improvements in machinery for manufacturing bricks, tiles, quarries, drain-pipes, and such other articles as are, or may be made of clay or other plastic substances. April 6; six months.

Samuel Fox, of Stocks Bridge-works, Deepear, near Sheffield, for improvements in umbrellas and parasols. April 6; six months.

William Watson Pattinson, of Felling-new-House, Gateshead, manufacturing chemist, for improvements in the manufacture of chlorine. April 6; six months.

Moses Poole, of the Patent Bill-office, London, gentleman, for improvements in covering wires for telegraphic purposes. (A communication.) April 6; six months.

John Walter De Longueville Giffard, of Serle-street, Lincoln's-inn, Barrister-at-law, for improvements in fire-arms and projectiles. April 6; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
April 2	3203	W. S. Adams	Haymarket	Sponging-pan or bath.
3	3204	Fenwick de Porquet, of the firm of Mary Wedlake & Co.	Tavistock-street, Covent-garden, and Fenchurch-street	The Utilitarian, or hay and straw-cutting machine with corn-crushing machine combined.
,,	3205	John Dangerfield	Hill-top, West Broomwich	Safety-valve and water indicator for steam boilers.

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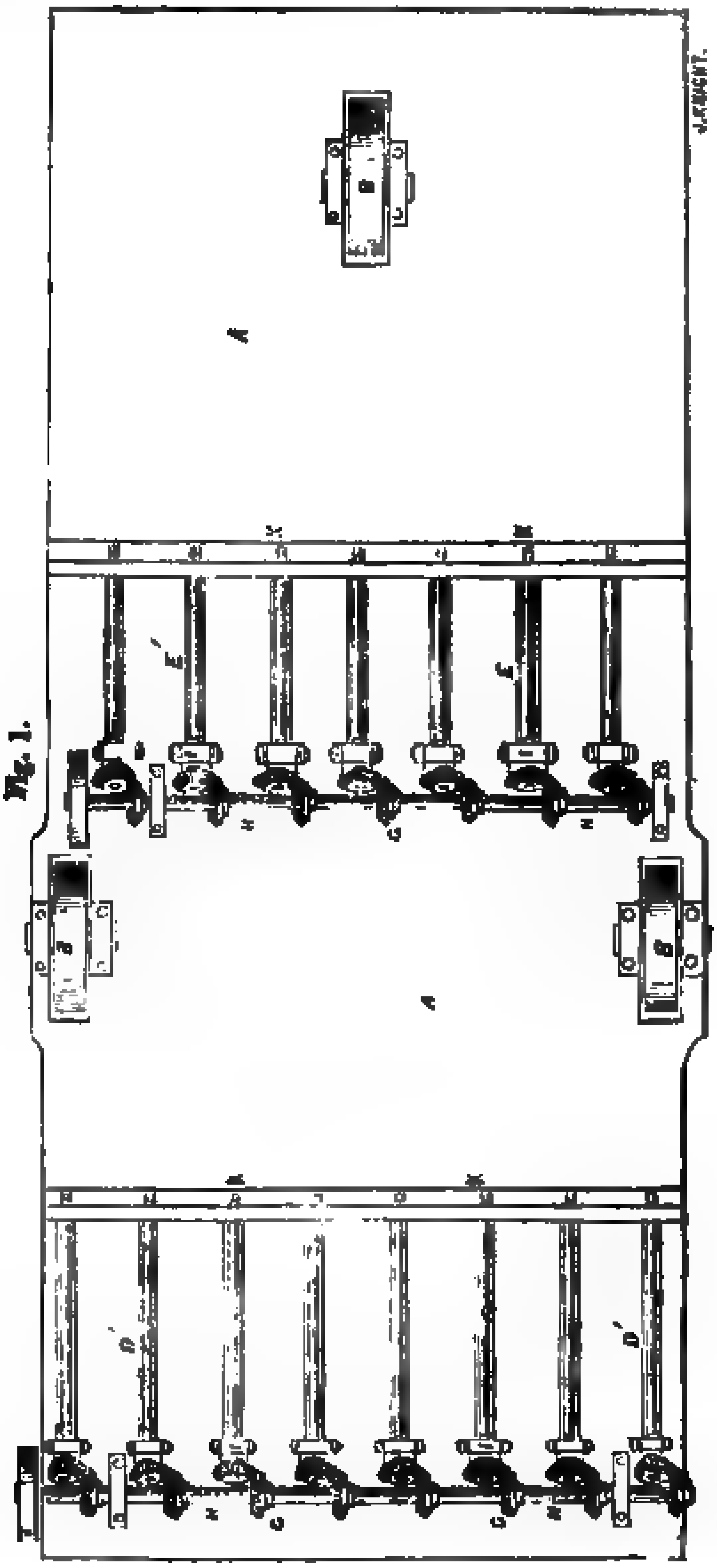
BROWN'S PATENT ROTARY DIGGER.

Fig. 2.



BROWN'S PATENT ROTARY DIGGER.

(From a Correspondent.)

The improved tilling instrument, of which some account was given in the *Mech. Mag.* of last week (p. 277), seems deserving of a greater degree of attention than it is likely to receive at the hands of agriculturists, from the undistinguished manner in which it was there presented to their notice. It is by far the most novel contribution to this numerous class of machines which has yet appeared, and is also of a much *likelier* character than most. If the comminuting and stirring-up of the soil be the great object to be accomplished by such implements—as it assuredly is—it would be difficult, indeed, to name one which can be compared with this for efficiency and rapidity of action. It is hoped, therefore, that a place will be found for the accompanying sketches illustrative of the construction of the machine, and to some practical details not to be found in the inventor's specification. They are forwarded to the Editor by one having no interest whatever in the invention apart from that of the public, but whose all is staked on the prosperity of agriculture, and whose wishes, therefore, are bound up in its improvement.

Fig. 1 is a plan or bird's-eye view of this machine; and fig. 2 a horizontal section of it. Only two rows of cutters are here shown; but it will be readily understood that this number may be increased, as also that the position of the cutters in respect to one another may be varied at pleasure. Either horse or steam power may be employed to work it, but, in either case, the wheels are so disposed that they shall always bear on new or uncut ground, on which, of course, the least tractive force is required.

The weight of the whole (3-horse power steam engine included) will not exceed *two tons*, to draw which four horses will be amply sufficient, especially as the steam power cuts its own way, and the horses have only to draw the weight of the machine and engine, and not to force the cutters through the earth, as they do the coulter of a plough. Therefore, the rate of progress over the ground will be in proportion to the velocity with which the cutters revolve, which may, in most cases, be reckoned as at least double that with which an ordinary plough can be pushed on the old plan of main force through the soil.

The width of soil which the revolving cutters can work (with 3-horse power engine) will be ten feet at a time. For fifteen cutters of three inches in diameter and fifteen cutters of five inches in diameter equal 10 feet. The reason why the forward cutters are made smaller than the hinder cutters is, that the forward ones enter and cut the earth with solid earth on each side of their passage, but the hinder ones cut the solid earth with loose earth on each side of their path, and consequently they can work easier. Cutters of all varieties in point of shape and size can be fitted into the sockets of the revolving spindles.

The work done will necessarily vary with the sort of power used and the nature of the soil; but it is important to observe, that whatever is done, *is done at once*,—no second ploughing or any harrowing; for the earth is completely cut up and pulverized by the cutters, so as to admit at once of the free *passage of air and rain*, there being no hardened substratum left at the bottom of the furrow, as in ordinary ploughing, to hold the water.

A further advantage attending this machine will be found to be that it may be applied in seasons when, owing to the hardness of the ground, the present agricultural implements are not at all available.

Agricola.

April 12, 1852.

TUBULAR SUSPENSION BRIDGE OVER THE WYE.

[This bridge, which is now in the course of construction to carry the South Wales Railway over the Wye, at Chepstow, is a modification of the plan designed by Mr. Fairbairn, and adopted by Mr. Stephenson, for the celebrated Britannia-bridge over the Menai Straits. Mr. Brunel suspends his main tube by chains; Mr. Stephenson also proposed to do the same thing, but was dissuaded from it by Mr. Fairbairn as being a contrivance inconsistent with the tubular theory, and of no practical utility. We extract the following particulars from the Reports of the progress of the undertaking given in the *Times*.—Ed. M. M.]

Chepstow, April 7, 1852.

The bridge, when completed, will be in length, from bank to bank, 610 feet. It will be of four spans, three of about 100 feet each, and one of 290 feet. The three smaller spans rest upon iron piers, filled with concrete, supporting cast-iron girders, on which the railway will be constructed. The fourth or principal span will be constructed upon the suspension principle, the great length of the girders requiring more support than that afforded by the piers alone at each extremity. Mr. Brunel has therefore constructed a tube 309 feet in length and 9 feet in diameter, which is now being raised to the summit of piers erected on the east bank, and in the centre of the river, and from which massive chains depend, which will be fastened to the girders, and will hold them up in the centre. The girders on which the railway will run, will be 50 feet above high-water mark at spring tides, which here rises higher than in any other river in the kingdom (50 to 60 feet). Of these girders, those for one line of rails are already fixed from the centre to the west bank of the river.

In commencing the operation of sinking the cylinders to form the piers of the bridge, the workmen had first to pass through 29 feet of blue clay and sand, below which they met with a thin bed of peat containing timber, some solid oak, hazel nuts, &c. After that was encountered four feet of fine blue gravel, and next came the bed of boulders, upon which the cylinders were originally intended to rest. Then came a bed of red marl, about five feet in thickness, beneath which was the solid rock, which resembles what is known as "millstone grit." Into this the cylinders were sunk (on the exhausting plan of Dr. Potts). The *modus operandi* was as follows:—The cylinders were placed on planks to prevent their cutting into the soft mud. One by one cylinders were added, until the column had reached the top of the stage, about 40 feet in height, which had been erected for the purpose of sinking the cylinders. The weight of the column then cut through the plank, and the cylinder descended about six feet into the mud. Men then descended into the cylinder, two or three working at it at a time; and, as they excavated the soil, so the cylinder continued to sink, and as the column descended, fresh cylinders were added at the top. The excavation then continued, without interruption from water or any other intrusion, until a depth of about 17 feet had been attained, at which point the water broke in from below in such force as to require the constant operation of two 18-inch pumps worked by an engine to keep it under. The water burst in at a moment's warning as soon as the spring was tapped; and the most remarkable phenomenon attending this occurrence was the fact, that the spring water invariably rose in the cylinder exactly to that height at which the tide was standing at the moment. That it was not an irruption of water from the river was beyond dispute, inasmuch as the water in the Wye at this point is, from the action of the tide, always tainted with mud, which is held in solution in great quantities at all times, whereas the water which rushed into the cylinder from below was of exceeding purity, and contained no particle of salt.

From the period when the spring was first tapped the pumps were obliged to be kept at work until the cylinders had been sunk to the rock, when they were filled with concrete. This irruption of water at a depth of 17 feet from the surface of the bed of the river was the same in the sinking of all the cylinders for the centre or principal pier; but the water did not interrupt the works to so great an extent in sinking the other piers; the workmen penetrated to a greater depth than 17 feet before the water broke in. The spring appeared to be in the bed of gravel about 12 feet from the point where it first burst into the cylinder.

Mr. Brunel and some of the principals of his staff having taken their station on the top of the tube, which was lying upon the stage erected for it, at right angles with the river, the word was given, and at a quarter to 9 o'clock (April 7, 1852), the operation of floating commenced. The tube was supported on a massive timber framework at each end, resting upon iron rollers lying across a railway; and powerful "crabs" were used for drawing and pushing the tube

along the stage, which projects 160 feet into the river. At the end of the stage three pontoons, braced together, were lying in the river, and these received the east end of the tube, which was made fast to it; and as the tube was projected forward, the pontoons were moved across the river, and kept in their direct course by cables attached to strong moorings both up and down the river, worked by other crabs upon the pontoons. Everything went on in the most steady and even manner. Gradually the huge tube glided from its place across the river, and at the expiration of exactly an hour the floating was completed, and the arrival of the one end of the tube on the east side of the river at a quarter to 10 o'clock was announced by some cannon placed at a short distance lower down the river. As soon as the floating was completed, tackle depending from the summit of the towers on the east side of the river was attached to that end of the tube, ready to commence the second operation of lifting each end of the tube alternately to a higher elevation. The operation of floating having been effected about the time of high water, the tube was kept in its position until nearly 12 o'clock, by which time, the tide having receded, had left the east end safely lodged on the platform prepared for it, at a short distance above high-water mark. The pontoons, which were constructed under the superintendence of Captain Claxton, and answered their purpose admirably, were then removed. Their buoyancy had been calculated to an inch, and there were three feet of freeboard.

Early in the afternoon, the most difficult operation having been successfully performed, the second operation of lifting the tube to a level with the railway commenced. For this purpose three sets of chain-lifting tackle are employed, the lower parts of these chains being of three-inch iron, each tested to bear a weight of 80 tons without injury. Suspension rods at these points pass through the diameter of the tube. These chains extend from a timber framing at the top of the east pier, 180 feet above the railway level, and are worked by three double crabs of great power, worked by twelve men to each. This process was being proceeded with when the last available train left Chepstow. Great credit is given to the principal foremen, to whom much of the important work of floating this tube has been intrusted —Messrs. Crew and Whitting.

Chepstow, April 10.

The operation of lifting the great tube for the bridge over the Wye, at this place, commenced on Thursday, as reported in the *Times* of Friday, and has been conducted up to this time with perfect success. The last report left the tube lying across the principal 300-foot span of the bridge, and the same evening the second operation of lifting up the east end of the tube to its second elevation on the rock, on a level with the railway, was commenced. This one end has now been lifted, and is deposited 50 feet above the other end, which will be hoisted next week. after the tackle has been completed for the purpose. The tackle used for this purpose is of a very powerful description. There are three sets of chain-lifting tackle, the lower parts of the chains being made of 3-inch iron, each tested to bear without injury 80 tons. Suspension rods at these points pass through the diameter of the tube, secured by collars and plates underneath it. The sheaves, of which there are three at bottom and six at top, are made of wrought iron by a patent process, and manufactured by Messrs. Samuda. The chains working in these sheaves are 1¼-inch diameter, made by Brown and Lennox, of Cardiff. The fall, or end of the chains, extends from the top of the timber framing, or lifting stage, a distance of 180 feet, into the rock cutting, and are there led to three double "crabs" of great power. Each of these were worked in the ordinary way, by twelve men to each crab. The lifting stage is built of strong timber, in the opening or space intended for the up line of railway, the top of it being about 70 feet above the rails.

When the tube shall have been raised to the requisite height, it will be securely propped under by timber packing, while preparations are being made to move it horizontally a distance of 20 feet to its destination over the down line of railway. This process will be effected by introducing under it a short length of railway, and the same description of rolling bars used in its passage from the yard to the pontoons. It will then be pushed gently along over the rollers by screw jacks. After reaching its right position the hydraulic press will be used to lift it a few inches above its eventual level, for the purpose of fixing very accurately the bed plate of solid cast iron and the permanent rollers upon which its future contraction and expansion, by reason of the change of temperature, will take place.

The tube now lies in an inclined position, one end being 50 feet above the other. Ordinary "trows," or barges and steamers, can pass under it close under the cliff. When it is raised to its final destination, a gangway will be suspended from it, upon which the workmen will proceed to construct the railway, or rather to fix the girders. These girders are ready in the Com-

pany's yard below. They will be raised in three parts; viz., one girder 120 feet in length (the middle), and two ends of 85 feet each. When the centre girder is brought up, the massive chains from the tube will be brought down and attached, and the two ends will also be attached to chains from the tubes in like manner. The roadway and materials for the permanent-way will then be brought up and put together, and one line will be opened. The present calculation is, that this opening may be effected in six weeks or two months, if no unforeseen accident occurs. That event will be a most important one to the welfare of the Company, inasmuch as it will enable the Company to introduce the mineral and merchandise traffic of the country upon the line. This traffic will be very great, and will form a principal source of revenue hereafter. The opening of one line of rails will suffice for this object; and as soon as that has been effected the two additional piers in the western half of the bridge will be constructed, and the second tube (now partly made and lying in the yard below), for supporting the up line of rails, will be raised. It is hoped that the whole bridge may be completed before the end of the present year.

The following statistics of this structure may be interesting:—

	Feet.
Total length of the bridge	610
Main span, eastern half	300
Length of the tubes	309
Diameter of the tubes..........	9
Height of the tube from foundation of piers, upwards of ...	200

PATENTS FOR THE APPLICATION OF THE WASTE GAS IN BLAST FURNACES.

[Numerous patents have been taken out in this country during the last twenty years for the application to heating purposes of the waste gas in blast furnaces; that is of the combustible gases previously allowed to escape unconsumed from the chimney top. So also in the United States, where recently the validity of patents of this nature has been under the consideration of the Courts, and has elicited opinions equally deserving the attention of the Old as of the New World. The following is the judgment delivered by Mr. Justice Kane, before the United States District Court, Pennsylvania, in the case of Detmold v. Reeves, on a motion for an injunction, September, 1851.]

This is an application for a special injunction to restrain the defendants from further violating the complainant's patent.

The complainant, Mr. Detmold, is the assignee, and, as such, the patentee in this country, of an invention made by Mr. Faber du Faur, and patented by him in 1840 and 1841, in Bavaria and Wurtemburg. The American patent was issued in 1842, but it was amended and re-issued in 1845. It is for "a new and useful invention for generating and applying heat;" and its immediate subject is a new mode of collecting, conducting, and using the combustible gases that ordinarily escape from the tunnel head of the blast furnace. The defendants are extensively engaged in the manufacture of iron, and it is charged that they are availing themselves of a part of the patented invention.

The interests which are involved in the controversy are very large, and may be seriously affected by the action of the Court on the present motion. The argument, therefore, has had the widest range—embracing the originality of the patented invention, its practically useful character, its identity in principle with the apparatus employed by the defendants, the right of the inventor and his assignee to protection under the Patent Laws, the regularity of the proceedings of re-issue, and their legal effect, as well as the policy of postponing the summary relief which it is the province of equity to administer, until after an adjudication of the merits by a court of law. But of these questions, which were argued by the learned counsel on both sides with characteristic ability, there is only one, after all, which, on a careful review of the whole ground, I deem it necessary to decide.

The claim of the complainant, as it has been expounded by his counsel in the present case, is for "a new method of economizing fuel, by using the waste combustible gases of the upper portion of the blast furnace, by drawing them off below the upper level of the charge, and conducting them through convenient passages to other fireplaces or structures, there to be burned as fuel." It does not assert an exclusive right to the use of gases from the tunnel head, nor to the employment of pipes or tubes for conducting gases; and very properly, for both of these were long ago familiar to the arts. Its essential characteristic is, that the gases are to be withdrawn "below the upper level of the charge."

Can such a claim be legitimately deduced from the terms of the patent before me? This is the controlling question of the cause.

The descriptive language of the specification does not designate, as the place for taking off the gases, a point "below the level of the charges;" an expression that would apply equally well to any and every

such point; but one "at or near that point of the furnace where the limestone employed as a flux is completely calcined, and the reduction or deoxydation has not yet commenced;" and this point, it adds, "will generally be at about one-third of the height of the whole furnace below the tunnel head, or two-thirds above the bottom stone."

It is true, that the formal claim at the close of the instrument speaks of drawing off the gases at "one or more points below the top of the fuel;" and if the expressions *fuel* and *charges* can be regarded as convertible, this would certainly countenance the exposition of the complainant's counsel. But it does not stand alone; and it cannot be interpreted fairly without giving effect to the words that follow it—"substantially as set forth in the above specification." There is then an important qualification of the broad language of the claim, — one that limits and defines it by a reference to the description that has gone before; and when the two parts are taken together, as they must be, they do not import the withdrawal of the gases from below the top of the charges generally, at any and all points whatsoever, but specially from at or near that point below the top of them at which the flux has been calcined, and the deoxydation is about to begin.

The explanatory or practical reference which is added in the specification to a point one-third below the top of the furnace, makes this even more plain. For the indication of a point, ascertainable by simple measurement, as the one that will in most cases conform the structural arrangement to the rule deduced from scientific principle, is almost a declaration in terms, that the patentee had in view a *particular* point, and did not mean to apply his claim to all points below the charges alike.

So far, then, as the motion for an injunction asserts as its basis that the defendants are using a device which has been specifically described and claimed in the patent, it cannot be sustained, since it is conceded that the defendants do not take out the gases "at or near the point at which the calcination is perfected, while the deoxydation has not yet begun," nor at or "about one-third of the height of the tunnel," measured from the top. But the question still remains, whether the defendants are not violating the patent substantially; deriving from it information essentially connected with its subject matter, and only so far varying their structure in form and proportion as to elude its terms.

There is no doubt that he who has discovered some new element or property of matter may secure to himself the ownership of his discovery so soon as he has been able to illustrate it practically, and to demonstrate its value. His patent, in such a case, will be commensurate with the principle which it announces to the world, and may be as broad as the mental conception itself. But then the mental conception must have been susceptible of embodiment, and must have been, in fact, embodied in some mechanical device or some process of art. The abstract must have been resolved into the concrete. The patent must be for a thing, not for an idea merely.

This limitation, it may be said, denies to some of the more important products of mind, what it concedes to others of lower grade. But it is not the less true on that account. Men may be enriched or made happy by physical as well as by moral or political truths, which, nevertheless, go without reward for their authors. He who devised the art of multiplication could not restrain others from using it after him, without paying him for a license. The miner who first found out that the deeper veins were the richer in metal, could not compel his neighbour to continue digging near the surface.

The more comprehensive truths of all philosophy, whatever specific name we give to it, cannot be specially appropriated by any one. They are almost elements of our being. We have not reasoned them out perhaps, and may even be unconscious of their action; yet they are about us, and within us, entering into and influencing our habitual thoughts, and pursuits, and modes of life, contributing to our safety and happiness; and they belong to us as effectively as any of the gifts of Heaven. If we could reach the laws of Nature, they would be, like water and the air, the common property of mankind; and these theories of the learned, which we dignify with this title, partake, just so far as they are true, of the same universally-diffused ownership. It is their application to practical use which brings them within the domain of individuals; and it is the novelty of such an application that constitutes it the proper subject of a patent.

But the contract of the public is not with him who has discovered, but him who also makes his discovery usefully known. If he has discovered much, and discloses little—if there has been revealed to him one of the *arcana* of Nature, and he communicates to the world only some one or more of its derivative and secondary truths, he patents no more than he has proclaimed. He will not be allowed afterwards, when the extent of his right shall be the subject of controversy, either by expanding into a general expression

what was limited before in a particular form, or by tracing out for us the line that leads back from consequences to their remoter cause, to initiate us inferentially into the radical mystery of his invention, and then argue that he had described it by implication from the first, and so claimed ownership of it in his patent.

If, as it has been contended with great apparent force, M. Faber du Faur was really the discoverer of the true theory of the blast furnace, so as to determine from it the point at which the carbonic oxide, having performed its chemical function, might be withdrawn without sensible injury; if he knew that the gases, when taken from openings nearer the boshes, were capable of more intense combustion, but that their withdrawal so low down impoverished the action of the furnace, and that when used at the tunnel head, after they had performed successively the offices of deoxydating the mineral, calcining the flux, and vaporizing the water of the charges, they were less available as fuel in consequence of their increased impurity;—and if, knowing this, he had taught the iron-master how to choose the best place for withdrawing the gases, having reference to the dimensions of his furnace, and the different sorts of fuel, and mineral, and flux employed in it, and with reference also, perhaps, to the purpose for which the flame of the gases was to be applied after they had been withdrawn, no one can doubt that he would have conferred a signal benefit upon the arts of the world. And if he had, besides this, devised some form or structure—some material arrangement, by which his discovery might be applied to use, I would be most reluctant to say, that his patent, properly drawn out, should be limited to the mere mechanical illustration, and could not cover effectually the whole ground of his discovery.

But M. Faber du Faur and his assignee, Mr. Detmold, have not done this. They have announced no new principle of science—no natural law. They indicate to us the place at which the gases should be taken out, first, by reference to a scientific problem, which they leave unsolved; and next, by a proximate reference to mechanical measurement. There is not, so far as my inquiries have gone, anything less definitely settled among the skilful in these matters than the point at which the calcination of the flux is completed, and the deoxydation of the mineral begins. Some deny altogether that any one point can ever satisfy both of the conditions; for they assert that the reduction always begins before the calcination is perfected; and all concur that the point, if there be one, must vary with the form and proportions of the furnace, and the chemical elements of the ore, the flux, and the fuel, and that it is, moreover, affected sensibly by atmospheric changes.

This indication is too vague, therefore, and, under the varying circumstances to which it must be applied in practice, too erroneous also, to vindicate for the patented discovery the broader or generic character.

The other indication, which refers to a proportionate distance from the tunnel head, "one-third, or thereabouts," is merely specific.

The interpretation, therefore, which I am constrained to give to the part of Mr. Detmold's patent, which is involved in the present discussion, limits his claim to the formal arrangement, without an assertion of right to any dominant principle. The defendants have perhaps derived instruction from his descriptions, and may even to some extent have modelled their furnace, with its appendages, upon a theory which they suggested. But it does not appear to me that they are infringing, or have infringed his patent.

The motion for injunction must be dismissed.

WAR ROCKETS.

One of the most remarkable, as well as most recent adaptations of gunpowder in Europe is in the war rocket. But the idea was by no means new. Indeed, Sir William Congreve never claimed the credit of originality. The Agneeaster of the Hindoos is supposed to have been a sort of rocket, and, during the middle ages, there appears to have been something of a kindred nature used in Europe. Joinville states that "it was thrown from the bottom of a machine called a petrary, and that it came forward as a large barrel of verjuice, with a tail of fire issuing from it as big as a great swan, making a noise in its passage like thunder, and seeming like a dragon flying through the air, and, from the great quantity of fire it threw out, giving such a light that one might see in the camp as if it had been day." So terrified was the army of King Louis at it, that a knight, named Gautier de Cariel, recommended that, when one was discharged, they should all fall prostrate, and beseech God to deliver them from the danger against which He alone could protect them; which was actually done. It is thought by some that this is a description of the celebrated Greek fire, but it would certainly seem rather to apply to a rocket than a burning liquid. The first certain account of the war-rocket in Europe occurs in a work entitled *Traité Militaire*, by Hanzelet, published in 1598. A chapter in this work is headed, "*Comme*

l'on peut tirer droittement une fusée à fleur d'orizon ou autrement," and in it is a description and wood-cut, showing the use of a rocket for military purposes. General Desaguliers tried many experiments, with the view of bringing it into use, but eventually abandoned the idea. Sir W. Congreve was, however, more successful, for he rendered the flight of this weapon more regular, and gave it a greater range. He also considerably reduced the length of the stick, and removed it from the side to the centre of the rocket. He further improved it by making the case of sheet-iron.

On the first introduction of the rocket it was imagined that it would supplant, or totally alter the practice of artillery, and that it would be equally applicable for battering fortifications or slaughtering men, and Congreve proposed that cavalry, infantry, and artillery should alike be furnished with a supply, and it certainly seemed to possess peculiar advantages. Its magnitude seemed unlimited; it is very portable, free from recoil, can be rapidly discharged, and is very destructive to buildings, setting fire to them when discharged amongst them. These sanguine expectations have not been realized, a want of sufficient regularity in flight rendering the rocket unfit for many purposes. Nevertheless, it is a useful and important arm, and further improvements of it may yet be admitted into the service.

The rockets now used in the service do not at all come up to the dimensions that Congreve first intended should be made, and they fall immeasurably short of some of which travellers give us descriptions. In Colonel Symes's *Embassy to Ava*, page 173, it is related that "the display of rockets was strikingly grand. The cylinders of the rockets were trunks of trees, 2 or 3 feet in circumference; these were bound by strong ligatures to thick bamboos, 18 or 20 feet in length. They rose to a great height, and, on descending, emitted various appearances of fire that were very beautiful." Colonel Symes, page 432, referring to some still larger rockets, says that, for cylinders, "the trunks of trees, bored in the manner of a pump, were used—the cavity of the cylinder 9 or 10 inches in diameter, the wood 2 inches thick, and length from 12 to 20 feet." Some of these rockets are said to weigh from 1,000 to 2,000 lbs.; and in Siam, it appears that they are used as instruments of execution—the criminal being bound to one, it is either discharged perpendicularly or along the ground, and the unfortunate creature is thus put to death in a most cruel manner. These large rockets show the great familiarity which the natives of the East have with their manufacture; it will not, therefore, be a matter of wonder to know that they used them much as we have them at present a long time before us. In the translation of the *Memoirs of Eradut Khan*, a Hindoo nobleman, by Captain Jonathan Scott, of the Company's service (London, 1786), "a rocket's flight" is frequently given to denote a certain distance; and the translator, in a note at page 36, says—"The rocket in India is used in war, and the chamber being made of iron, does execution wherever it strikes, but cannot be sent in true direction; it will reach from 300 to 400 yards."

Some experiments were conducted in India in 1824, as to the relative merits of Congreve's rockets, and some prepared by Major Parlby of the Gunpowder Works at Allahabad; and it would appear by the Report of the Committee that the latter were much superior in regularity of flight and direction. But Major Parlby's improvements have not been adopted, owing, it would seem, to some difference as to the amount of compensation to be granted him.

Rockets were originally made with a shot, or shell, at their head, according to the nature of the service for which they were designed. They are now, however, only prepared with shells, because they answer equally well for shot, by emptying them of powder. Rockets are generally discharged from tubes or as a ground volley. The tube for the purpose is open at each end, and the necessary degree of elevation is given by a sliding support and screw at the back part of the tube, a graduated scale being attached to the upper portion, by which the degree of elevation is taken. A ground volley is fired by laying the rockets at specified distances from each other on the ground, and connecting them together by quick-match. They may in this manner be fired in quick succession, the match carrying the fire through the whole series. For the first 100 or 150 yards, if the ground be tolerably level, they will advance near the surface; but after this they rise, and rush about in a most destructive manner—hissing and plunging, and changing their course at every impediment they meet, now losing their energy, and again starting as with renewed vigour into the thickest ranks, destroying and burning wherever they strike, and carrying confusion into the best disciplined corps.

Rockets have done good service upon many occasions; they were first employed at Boulogne in October, 1806, and "in about an hour," says Congreve, "about 200 rockets were discharged; the dismay

and astonishment of the enemy was complete—not a shot was returned—and in less than ten minutes after the first discharge the town was discovered to be on fire." They were subsequently used at Copenhagen, Leipsic, Algiers, and other places. At Leipsic, it is related that a mass of French infantry laid down their arms at the first volley of the new weapon, terrified at the devastation and slaughter it effected.

Rockets are of a very perishable nature; the cases are soon eaten through, there being nothing but a lining of brown paper between the composition and the case; and the strong affinity that exists between the nitric acid of the former, and the metal of the latter, no doubt, greatly accelerates the result. They also suffer, and, in fact, become dangerous, when exposed to extremes of heat and cold, from the alternate expansion and contraction of the cases, causing a separation between the composition and the case. It would seem, however, that both these evils might be cured by one remedy, namely, by placing a tube of India-rubber between the composition and the case. By boiling the caoutchouc first for about twenty minutes in water, a degree of elasticity would be given to it that cold would not overcome; and it would expand as the heat increased, and thus filling out the case, would prevent any chance of explosion. The India-rubber would also effectually cut off any communication, and prevent chemical action taking place between the composition and the metal.—*Notes of Lectures by Mr. Lake, at the Royal Naval College Portsmouth.*

THE LOSS FROM THE USE OF SALT WATER IN MARINE STEAM ENGINES.

In steam boilers using salt water, it is necessary to extract or blow out a portion of the partly saturated water at intervals, or by a continuous process, to prevent a deposit of solid matter on the internal surfaces. The water blown out or extracted being much hotter than when it entered, must be the cause of an increased consumption of fuel, and may be explained, or estimated, as follows:

Sea water contains about one pound of salt and other solid matter in every 32 lbs. of water; its density is then called $\frac{1}{32}$, being $\frac{1}{32}$nd part of salt, &c. When reduced by evaporation to half that quantity, the same amount of salt is still in that water, and is then in the proportion of 2 lbs. of salt to 32 lbs. of water, or at the density of $\frac{2}{32}$, &c.

It is evident that when keeping the water in the boiler at a density of $\frac{2}{32}$, one part is used for steam, and an equal quantity must be blown out; then as much salt, &c., will go out in one gallon or foot as entered in two gallons or two feet, and as long as this proportion to that evaporated is blown out, the water in the boiler will be kept at that density.

If the water in the boiler is kept at the density of $\frac{3}{32}$, then two parts will be used for steam, and one part must be blown out; then as much salt, &c., will go out in one part as entered in three parts.

Taking the latent heat of steam at 990°, sensible heat 212° = 1202°, the total heat in steam.

The quantity of heat necessary to evaporate one volume of water is 1202°, less the temperature of the feed water entering the boiler, which is generally about 100°; taking this from the sensible and latent heats = 1202° − 100° = 1102°, which must be imparted to it to cause it to assume the form of steam.

The part or water blown out has to be raised from the temperature of the water entering to that leaving the boiler. Water entering 100°, that blown out 250°, difference or loss, 150°.

The proportion or loss is shown as follows: Suppose two volumes of water enter the boiler, and the density is to be kept at $\frac{2}{32}$.

One volume is formed into steam, and requires	1102°
One volume is blown out containing	150°
The quantity of heat required..	1252°

The 150° blown out, being necessary to keep the boiler from incrustation, is the part lost; therefore,

$$\frac{1252}{150} = \frac{1}{8\cdot34} \text{ part,}$$

equal to 11·98 per cent.

If the water in the boiler is kept at $\frac{3}{32}$, then, if three volumes of water enter the boiler, two are formed into steam—

Each requires 1102° = ...	2204°
One volume blown out containing ..	150°
Quantity of heat required .	2354°

As above, 150° blown out, then

$$\frac{2354}{150} = \frac{1}{15\cdot69},$$

equal to 6·37 per cent.

The following formula will answer for calculating it:

Let H represent the sum of the sensible and latent heats.

D the difference in temperature of the water entering and that leaving the boiler.

T the temperature of the water entering the boiler.

E the proportion or quantity of water evaporated, the quantity blown out being constant, or represented by 1·000.

Then

$$\frac{H - T \times E + D}{D} =$$

the [1] part of the heat lost.

Or

$$\frac{D}{H - T \times E + D} =$$

the per cent. of loss.

The following is calculated by this formula:

Example for the Density of $\frac{1\cdot 5}{32}$.

$H = 1202°$ $T = 100°$ $E = \cdot 5$ $D = 150°$

		Per cent.
	$1202 - 100 = 1102 \times \cdot 5 = 551 + 150 = \frac{150}{701}$	21·39
At $\frac{1\cdot 75}{32}$	.. ..	15·30
At $\frac{2}{32}$	$1202 - 100 = 1102 \times 1 + 150 = \frac{150}{1252}$	11·98
At $\frac{2\cdot 25}{32}$	.. ..	9·80
At $\frac{2\cdot 5}{32}$	$1202 - 100 = 1102 \times 1\cdot 5 + \frac{150}{1803}$	8·30
At $2\frac{3}{4}$	.. ..	7·29
At 3	.. ..	6.37
At $3\frac{1}{2}$	.. ..	5·60
At 4	.. ..	4·30

The amount of loss stated above occurs when enough is blown to keep the water at the densities given. To keep the boiler clean, the water should not be allowed to get more lense than $\frac{2}{32}$ in the Atlantic Ocean, but, to be sure, it should be kept rather less in the Gulf of Mexico—not more than $\frac{1\cdot 5}{32}$. In steamers having no indicator of this kind, they very probably keep the water less than $\frac{1\cdot 5}{32}$, and most of them that have them keep it at $\frac{1\cdot 75}{32}$, with a loss of from 14 to 21 per cent, of fuel. The above proportion of loss is when steam of two atmospheres is used; the loss increases as the pressure of steam used is greater, in consequence of the water being blown out at a higher temperature.

The saving in the cost of fuel is but a small part compared to other advantages, such as increased durability of boilers, greater safety, increased stowage of freight, &c.—W. S.—*Franklin Journal.*

FABER'S MAGNETIC STEAM BOILER GAUGE.

Report by the Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, to examine "a Magnetic Gauge, for indicating the height of water in Steam Boilers," invented by Mr. George Faber, of Canton, Ohio.

The Committee report,—That they have examined the construction and operation of the same, and consider it to possess the following advantages:—Simplicity of construction and operation; freedom from friction, no portion of it working in a stuffing-box; durability as to time of use—some that have been used four years are as perfect and act as well as when first put up.

It indicates the exact height of water in the boiler, and the indication is visible. It indicates its own derangement, for when not working properly the needle becomes fixed, while it has a slight tremor when in action.

Considering this gauge to possess the above advantages, and having tested it for nine months accurately, on a tubular boiler using 80 lbs. of steam, the Committee confidently recommend it to general use, considering it a valuable improvement, and one that will conduce to the safety of steam boilers in general.

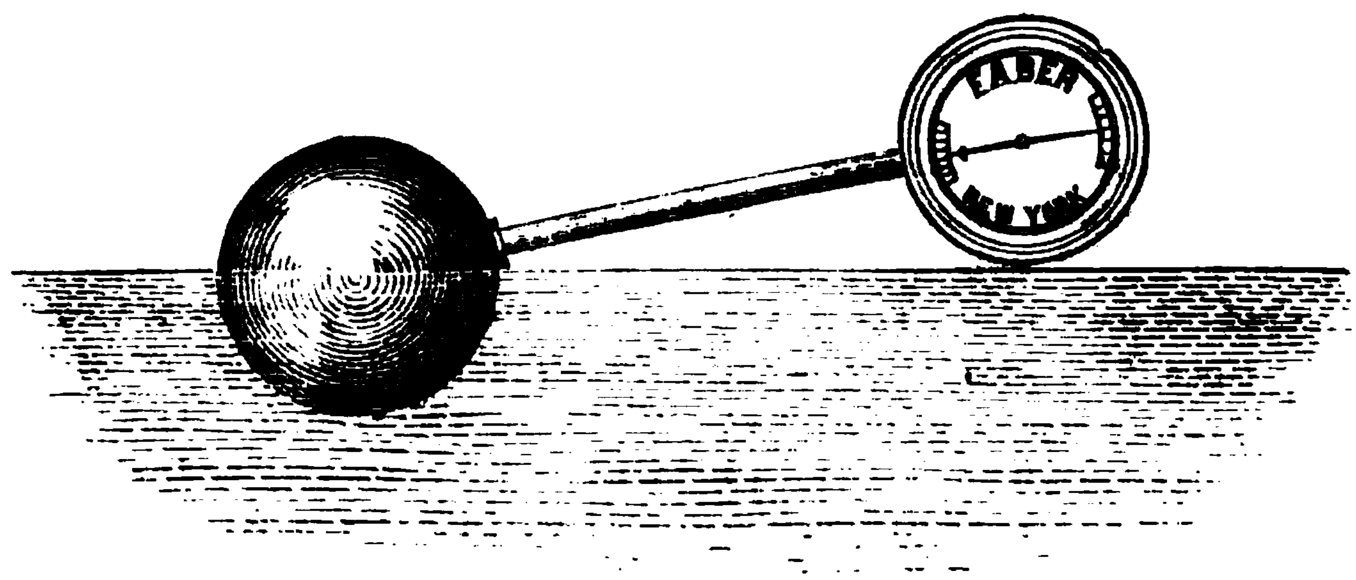
By order of the Committee,

WILLIAM HAMILTON, *Actuary.*

Description.

The gauge consists of so few parts, and is so extremely simple, that a glance almost at the drawings will serve to make it understood. It consists of a heavy copper sphere or ball, made to withstand the required pressure; this ball floats on the water inside of the boiler, and is attached to a brass rod, cranked near one end, which passes through a long pipe or journal, terminating in a circular plate. The end of the rod extends a short distance beyond the plate, and is fitted

to receive a steel magnet, having its positive and negative poles. The cranked end of the wire plays in the journal with perfect freedom, having *no stuffing-boxes or packing of any kind about it;* hence there is no friction.



Outside of the circular plate there is a cap fitted to screw on, forming a chamber for the magnet to work in. The front of this cap has a recessed space, on the front part of which a dial or index is put. A pin projects from the centre, on which a steel needle is placed, and at the outer edge of the rim a glass shade is secured to keep out dust, &c. The instrument is put in operation as follows: First, find a proper spot on the front of the boiler to place the index or dial; this should be a little above the range of the place where the middle cock is ordinarily put. See that from this place there is room for free play of the copper ball inside the boiler. Then drill a hole through the spot selected, large enough to receive the stem or pipe to which the index is attached; pass this stem through and set up the pinch nut on the inside, pack the outside nut with a pasteboard washer against the boiler, screw on the dial cap, and make a *tight joint* where it meets the circular plate. Shoe-thread wound a few times round, or Fuller's pasteboard will answer: *but remember, put no lead or other cement anywhere on the gauge.* Screw on the ball and fill up the boiler, adjust the dial and float so that the needle will lie horizontally, when the water is at the desired working level in the boiler. If the ball now has free passage of all stays or other obstructions throughout the whole range of motion, nothing can prevent the accurate working of the instrument. To keep it in perfect order for any number of years (for the magnet has been so prepared that it will not lose its influence), there is but one thing more required, and that attention is only necessary where muddy or other impure water is used. It will be seen that steam and water have free access to the *magnet chamber* through the tube. Where the water is used to make steam, *sediment* may collect in this place, and possibly might interfere with the *free* action of the magnet. To prevent this, a small blow-off cock is attached, which must be occasionally opened when there is a head of steam on, which will at once drive all sediment out. Any engineer will easily observe how often this is to be done. In some places it is not requisite for months; in others it will be well to do it once a day. In setting the ball, sometimes a stay interferes with the rod on which it is screwed. In this case the rod can be bent up or down to clear it. It will also be found too long to be admitted into small boilers: in this case the rod must be shortened, by giving it a waving shape, thus ~~~~. When the rod is left of the full length, the graduations on the dial indicate spaces of 2 inches.

MR. HANN'S MATHEMATICAL WORKS.*

1. It always gives us sincere pleasure when we can recommend a scientific work to our readers which is cheap and good. Each of the Treatises before us deserves this double recommendation in a high degree. The author has been long known in the scientific world as the coadjutor of the late celebrated Dr. Gregory and the accomplished

* 1. Rudimentary Treatise on Plane and Spherical Trigonometry.
2. Examples on the Integral Calculus, for the use of Schools.
3. A Short Treatise on the Steam Engine, adapted to the use of Schools, in which are given practical rules for the use of Engineers.
London: John Weale, 59, High Holborn.

Woodhouse, in publishing the very useful "Astronomical and Nautical Tables" as supplementary to the "Nautical Almanac" and "White's Ephemeris," and also as the author of several valuable works on mechanics and other subjects.

There is a class of mathematicians almost indigenous to England, for which we always feel the most unfeigned respect, we mean that comprised of men whose hands and clear heads alone have enabled them to work their way up through difficulties of all kinds to scientific distinction, and to fill posts of responsibility; we believe that Mr. Hann comes within the rank of these genuine sons of science in a very distinguished manner; at all events, each of his works evinces the clearness, the distinct comprehension, and the rigid exactness which fully entitle him to be placed in that category.

A generation or two ago, when we were teaching ourselves the mysteries of Trigonometry, we had "Bonnycastle's Treatise" as our guide, which, we believe, cost us twelve shillings; here is Mr. Hann's book, containing a condensation, by a master hand, of all the useful matter in the works of Bonnycastle, Cope, De Morgan, Gaskin, Hall, Hind, Hymers, Snowball, Woodhouse, Gregory, and Davis's edition of "Hutton's Course," with a selection of problems, principally taken from the *Ladies' and Gentleman's Diaries*, the "Cambridge Problems," and *Leybourne's Repository*, together with Lefebvre de Fourcy's Demonstration of Demoivre's Theories, &c., &c., published in clear type, on good paper, and neatly done up, for two shillings!!

The book contains less dissertation than our old friend "Bonnycastle's Treatise," but we think it comprises more genuine Trigonometry,—there is no chaff to be blown off, the work is the essence of its subject.

We have no wish, however, to speak in disparagement of Bonnycastle, who rendered good service in his day; nor shall we enter upon Mr. Keith's complaint, that all Bonnycastle's treatises were not his own; but we strongly recommend Mr. Hann's neat little book as being as complete and masterly as it is cheap and neat. In looking through it, we cannot help contrasting the easy and inexpensive course of the student of these days with that which it was our fate to follow. In addition to wading through Bonnycastle's ponderous volume, at a cost of twelve shillings, some years after, when we came to Cambridge, and had to attend the lectures on trigonometry, a treatise on the subject had just come out, at the price of eight or nine shillings, which each student was advised to read. The lectures on spherical trigonometry were given some time after, and in the interval another edition of the aforesaid trigonometry had been published, containing spherical trigonometry. Each of us was almost obliged to get that also, at a cost of ten shillings, the former edition being worth little or nothing. Part of this was a bookmaker's and a bookseller's trick; we name the circumstance only to assure the student that he will have quite as complete a course of trigonometry in Mr. Hann's book for two shillings, as we obtained, back in those ancient times, for more than ten times the amount.

Trigonometry is of universal application in mixed mathematics. Scarcely a step can be taken in the higher branches without the occurrence of expressions requiring a familiar acquaintance with trigonometry for their unravelment. Astronomy is almost wholly based upon it.

Whoever, therefore, aims at the attainment of such knowledge to any extent, cannot adopt a safer course than as early as possible to make himself thoroughly acquainted with Trigonometry and expert in the application of its formulæ. The book before us is admirably adapted for this purpose, and we strongly recommend it to teachers, and especially to students who teach themselves.

2. The integral calculus has been termed the inverse of the differential—just as division is of multiplication, and the extraction of roots is of involution. The object, therefore of the integral calculus is to find a function from which a given differential coefficient

may be derived. Were all differential coefficients obtained by direct differentiation, the inverse process would for the most part be comparatively easy. But this is not very often the case; in most instances the expression to be integrated arises from a function that has been multiplied by the symbol of differentiation—that is if $\phi(x)$ be the function we have to integrate $\phi(x).dx$, and not $d.\phi(x)$. Hence integration becomes a far more intricate process than differentiation. Perhaps there is no branch of pure mathematics which calls the inventive faculties into operation more frequently than integration. The common forms are easily managed; but the expressions which result from the investigation of physical and other problems, sometimes elude all the artifices of reduction, subtraction, and transformation—and not unfrequently baffle all the subtle ingenuity of the most experienced analysts. Some of the Eulerian integrals, as they are termed, may be named as belonging to a difficult class; we intend at some time to give the investigation of one of the most useful of them

$$\left(\int \frac{x^{s-1}dx}{1+x^{s}}\right),$$

which seems to admit of a more simple elucidation than that given by Hymers and others.

Readiness in integrating can be acquired only by practice—even that intuitive sort of insight which the skilful analyst appears to possess when operating upon an involved expression, is very often only the result of study and practical application. The mind of such a mathematician has acquired the habit of ting fractions of this nature, and of perceiving at a glance the different parts into which they may be resolved. Perhaps there is but one way leading to the attainment of this expertness in treating the intricate subject—and that is, through the solution of numerous examples. The dexterous anatomist does not acquire the delicate touch, upon which so much of his success and usefulness depends, without a long course of practice and careful observation—our subject requires a drilling of the same kind. Mr. Hann's examples are judiciously selected and arranged for such training. The book must prove highly useful to teachers and students. "Peacock's Examples" are become scarce and expensive. "Gregory's Treatise," though excellent, is rather too bulky, and costs too much for students of a certain age and grade. The object and nature of Mr. Hann's book are best explained by the Author himself, who says, "As this book contains a great number of integrals fully worked out, the Author hopes that it will considerably facilitate the progress of those entering on this branch of study by showing them almost all the artifices that are used in those branches that come within its scope. The works that have been consulted are those of—Peacock, Gregory, Hall, De Morgan, Young, and various mathematical periodicals; also the excellent little work on the 'Calculus,' by Mr. Tate, which, like all the productions of that eminent writer, abounds with useful information, apart from the able manner in which he has treated the first principles. When integration by parts is used, the whole process is put down, but the student should endeavour as soon as possible to acquire the facility of running off the quantities without writing down all the intermediate steps."

The contents of the book are:

Elementary, integrals to be committed to memory—with examples worked out once for practice. Rational Fractions. On the method of integrating by parts. Formulæ of reduction. Logarithmic formulæ. Trigonometrical functions, or, as Hirsch terms them, "transcendental differentials." Definite integrals. Areas of curves. Volumes of solids, &c., with many examples in each worked out in a manner which the student may profitably adopt as his guide for elegance and exactness. There is also a set of miscellaneous examples at the end—valuable and interesting.

The book is clearly printed on 128

pages, neatly put together, and the whole rendered to the student for ONE SHILLING!! Taking into account the nature, the quality, and the quantity of the subject, and the mode in which it has been treated, we think we may venture to assert that the book is a singular specimen of cheapness and usefulness: for these attributes we know nothing like it in the English language—we much doubt if its equal can be found in any other. When we remember how difficult and costly it was to obtain anything of the kind years ago—it almost creates a desire to go back and begin again for the purpose of having this advantage which now attends the student.

3. Perhaps no other achievement of human genius has conferred so much real benefit on the whole race of mankind as the STEAM ENGINE. Its powers appear to be boundless. We can contemplate only to some extent what it has effected, but it is impossible to prescribe limits to its applications. Already it performs nearly the whole traffic of the nation, and has, as it were, brought the most distant parts of the country close to each other. It enables the miner to penetrate deeper than formerly in his search for ore;—it brings up all the produce of these underground domains, and most of the other mining processes are performed by this powerful agent. Our vast piles of machinery, that rear their stupendous heads throughout our manufacturing districts, no longer depend upon the wind or water for their motion;—the steam engine supplies the place of, and, in some measure, commands both. Immense ships are taken across the ocean by the same instrumentality,—the wind and the waves seldom counteract its impelling powers. To our great national concerns—mercantile and marine—the steam engine has become an indispensable agent. Although it be the promoter of peace and freedom, it has, perhaps, doubled the powers of the country for belligerent purposes. These are only a few of its performances—the achievements of its infancy. Its powers are extending every day. No doubt, hereafter, it will be applied extensively to agricultural affairs; there can be no reason why the plough should not be worked, and the wagon drawn, by it. Very likely, in the course of time, instead of ordering horses to be got ready for taking a carriage, the order will be "to get the steam up." In a social point of view, it is working, and will bring about surprising vicissitudes: imagination can hardly set bounds to its powers. As events are now progressing, matters hitherto complicated and expensive may, by-and-bye, be rendered by this necromancer simple and cheap; for instance, the law may be so codefied and reduced to mere yes-and-no simplicity, that an appropriate little engine may be made to expound it at the expense of a small quantity of coke or coal. Nay more; when we see to what a mechanical passiveness a very nondescript sort of despot has reduced one of the most polished and high-spirited nations in the universe, it would be unsafe to predicate that, a few centuries hence, the tyrant rulers of nations may not be things of construction—contrived to "DECREE" by the consumption of a given quantity of the best Newport or indifferent Newcastle. However, leaving the application of the steam engine to legal and regal affairs entirely to fancy's foretellings, it is quite obvious that a lucid exposition of the mathematical principles which apply to its numerous performances must be interesting to all parties concerned in its improvement, and serviceable to engineers and others who are engaged in its construction and management. Mr. Hann's treatise for that purpose is a useful *vade mecum*. For the special service of the classes just referred to, and for the enlightenment of others who may wish to become acquainted with the mathematics of the important subject, Mr. Hann has condensed all that suited his object found in "*La Theorie des Machines à Vapeur*," *par Pambour*; "*La Mécanique Industrielle*," *par Poncelet*; "Moseley's Mechanical Principles of Engineering;" "Tredgold on the Steam Engine," by Woolhouse;

"*La Mécanique Practique*," *par Morin*; Professor Willis's "Principles of Mechanism," &c. In addition to these, the valuable works of Mr. Tate, Professors Millington and Robinson, Messrs. Dodds, Pole, Templeton, &c., have been pressed into the service of the work. The exposition of "Marriott's Laws of Expansion" will, we think, be found useful to the practical engineer. There are also formulæ and rules, with practical examples, on the work done with reference to the expansion—the pressure at different positions of the piston — the work done by the engine on the piston per minute — the duty of an engine — the safety-valve—the safety-valve lever—parallel motion — finding the length of the connecting rod—constructing an eccentric wheel—the crank—the fly-wheel —the friction of the fly-wheel—the governer, &c.

There are also miscellaneous examples to exercise the student, and a table of hyperbolic logarithms, which will be found useful in various parts of the work. These matters are brought down to the simplicity of school exercises. To the young engineer who is desirous of being well grounded in the scientific part of his profession, the book is truly valuable. It will also be of essential service to that class of readers who, at a small cost (three shillings and sixpence) wish to acquire some mathematical knowledge on the subject, though not with the view of becoming engineers.

The lucid manner in which the Author has treated this somewhat complicated subject, leads us to point out another topic to his attention. In works on dynamics, &c., when a problem has been enunciated, a differential equation is frequently at once set down as applicable to the condition, leaving the student to find out, if he can, why it is that that equation suits the problem better than any other. Perhaps we shall best explain our meaning by giving an example. "A body falls towards a centre of force which varies as the inverse cube of the distance in a medium of which the density varies also as the inverse cube, and of which the resistance varies as the square of the velocity; to find the velocity or any distance from the centre."

"Let x represent the distance of the particle from the centre, after a time t, and let a be the central distance. Let k denote the force of resistance at a unit of distance for a unit of velocity, and μ the absolute force of attraction."

"Then, for he motion of the particle,

$$\frac{d^2x}{dt^2} = -\frac{\mu}{x^3} + \frac{k}{x^3}\,\frac{dx^2}{dt^2}."$$

"Now, why," the novice in such matters, may inquire, "does this differential equation represent the state of the particle at some point in its progress?—In what manner is the expression on the first side of the equation made to apply; and why is the sign of equality placed between it and that on the other side?" Such inquiries may be referred to the equations of motion, coupled with fundamental principles, for an explanation. Still, it is known that students have frequently great difficulty in perceiving the relation which a differential equation is made to bear to a body in motion — nor is the perplexity much less in comprehending why certain differential impressions should represent a body in motion in one position, and the integral of that expression denote it in another state; the difficulty perhaps originates in obtaining a clear perception as to how the processes of differentiating and integrating can apply to the state of a body in motion. We think some writers on dynamics, &c., have not been sufficiently explicit upon the subject. They are too apt to give the equation of motion, as the first step, as in the above example, leaving the student to cudgel his brains for reasons and explanations. Dr. Whewell has censured analytical mathematics, as having a tendency to pass over reasonings upon subjects as briefly as possible. In the instance he has cited, if the student's object be merely to solve the problem, the chief point is

to recollect the equation, and so of others; and clearly, if this habit be carried to any length, it is just possible that a student may qualify himself to solve a number of problems, mechanically as it were, without reasoning much upon them. We think the authors who do not take the trouble to explain fundamentally in what manner analytical expressions apply to the different conditions of problems, have been instrumental in forming such unreasoning problem solvers. "Walton's Mechanical Problems," from which the above was taken, is a very valuable compilation of the kind; but English students want another of the same kind, in which reasons for the analytical processes and applications are more extensively given. We think such a work, if judiciously treated, would not only be most serviceable to students of all descriptions, but that it would materially remove the stigma which at present attaches to analytical mathematics, as being notative and unreasoning. Mr. Hann possesses just the qualifications to write such a work: we shall be pleased if our remarks should induce him to undertake and complete it.

We must not conclude our notices without calling our readers' attention to Mr. Weale's series of other rudimentary works. They will find that they can obtain treatises on a great variety of mathematical and scientific subjects, by the best writers, *at a shilling per volume*. The works are carefully and neatly got up, and we are of opinion that the British Public is indebted to the Publisher for his eminent services on behalf of popular and general science.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING APRIL 15, 1852.

HENRY CURZON, of Kidderminster, civil engineer. *For improvements in the manufacture of carpets and rugs.* Patent dated October 9, 1851.

These improvements consist in employing additional warp together with additional throwing in of weft to each wire inserted in weaving Brussels and velvet piled carpets and rugs.

When using printed or parti-coloured warp in such manufacture, it has been a common practice to have three warp threads, consisting of the printed yarn for making the surface, a thick filling warp for making the body of the fabric and a fine linen warp for binding the fabric together, by throwing one shoot of weft over, one under, and one over after the insertion of each wire. This method is commonly known as "three shoot" weaving, and differs from that of the patentee, inasmuch as he employs an additional filling warp together with the additional throwing in of weft. The ordinary thick filling warp may be composed of any suitable fibre, and it is preferred, that this, as well as the additional thick warp, should be as large as the reed will conveniently admit of. In weaving, the thick warp remains stationary, but the additional warp is raised up and down in forming sheds, and the working is performed in such manner as to introduce four shoots of weft to each wire, and all the shoots may be of the same weft or part of thicker weft than the rest. If fabrics are required of still greater thickness than can be produced by the use of a second thick or filling warp, another may be added thereto. An arrangement of loom is described for carrying out the invention, in working which a shed is to be opened to receive a wire; then a shed is opened by raising one-half, or every other yarn of the binder warp, and a shoot of weft is thrown over the worsted; the same half of the warp is then depressed, and the other half, together with the additional thick warp, raised, and a second shoot is thrown in. Half the binding warp is then raised, the other warps being depressed, and a third shoot is thrown in; the additional filling warp is thus depressed, all the other warps being above. A fourth shoot of weft is then thrown in, by which it will be seen that there is at all times a shoot of weft between the two filling warps for each wire introduced. After putting in the next wire the working proceeds as before, only that the half of the binder warp which in the above description was directed to be raised will be depressed, and the other half raised.

Claim.—The mode described of weaving carpets and rugs.

JOSEPH PIMLOTT OATES, of Lichfield, surgeon. *For certain improvements in machinery for manufacturing bricks, tiles, quarries, drain pipes, and such other articles as are or may be made of clay, or other plastic substance.* Patent dated October 9, 1851.

The improved machinery which constitutes the subject matter of the present patent is adapted for the manufacture of bricks, tiles, &c., by moulding. The clay in a plastic state is fed into a vertical hopper of a circular section, the upper portion being cylindrical, the middle, of the form of an inverted truncated cone, and the lower portion, cylindrical, but gradually contracting towards the extremity to the shape of the brick mould used. This contracting portion the patentee calls the "rectum." Withinside the upper parts of the hopper is fixed a shaft, to which are attached by bosses a series of knives or blades, each pair being at right angles to the pair immediately preceding it, and the knives or blades of each pair being inclined in opposite directions. The blades are of different lengths to suit the varying dimensions of the interior of the hopper, and those at the upper part are placed at greater distances apart than those in the lower and conical part. Within the "rectum" is placed a vertical revolving screw, the threads of which come almost in contact with the sides of the interior. The clay is fed into the hopper and tempered by the action of the knives or blades on the revolving shaft; it is then carried down by the screw in the "rectum" and forced from the orifice thereof into one or other of the moulds. The moulds are formed in a sliding frame which has a reciprocating movement immediately under the orifice of the "rectum," so as to bring the moulds alternately into a position to be filled by the clay in its forced descent. When one mould is filled the sliding frame is caused to move sideways, so as to clear the filled mould from the orifice and bring the second mould under it to be filled. The same motion causes also the top and bottom of the moulded brick while in the mould to be planed or smoothed, by the sliding frame passing between two flat surfaces in contact with its upper and lower sides. The moulded bricks are removed by the action of pistons, which force out the bricks on to a travelling web, from which they are taken to be stacked and burnt. For the purpose of forming other articles than bricks and tiles, the orifice of the "rectum" must be made of a form corresponding to that of the mould employed.

Claims.—1. The arrangement of knives or blades described.

2. The forcing of the clay or other plastic substance of which the bricks, tiles or other articles are to be formed through the contracting opening described, and called the "rectum," whereby the clay or other plastic substance is brought to a compressed state.

3. The reciprocating frame carrying the moulds on which the bricks or other articles to be manufactured are formed; the planing or smoothing the top and bottom of such bricks or other articles by causing the moulds in which they are formed to pass between two plane surfaces; and, the removal of the bricks or other articles from the moulds by pistons, as described.

JAMES FREDERICK LACKERSTEIN, of Kensington-square, gentleman. *For improvements in obtaining motive power.* Patent dated October 9, 1851.

These improvements consist of certain combinations of means and apparatus for obtaining power by the use of carbonic acid gas.

The apparatus employed for generating the gas, and bringing it to a fit condition for use in the engine, consists of three vessels—a generator, a purifier, and an expander. These vessels are each of a cylindrical form with hemispherical ends, and are connected with each other by suitable arrangements of pumps and pipes. The materials from which the gas is obtained (and which the patentee prefers to be sulphuric acid and carbonate of soda in solution, or other equivalent materials yielding residuary products of commercial value) are pumped in atomic proportions into the generator, and caused to combine intimately by traversing a percolator filled with broken glass or other such materials, whereby an extended surface is obtained. After passing through the percolator, the used materials are collected at the bottom of the vessel, and discharged from time to time by means of a self-acting float valve, which rises from its seat when the liquid has attained a certain level, and falls again and closes the exit orifice when, by the discharge of part of the liquid, the level of the liquid in the generator is reduced. In order to prevent the float being crushed by the pressure of the gas, it is perforated at the top, whereby gas is admitted, and the interior filled at the same pressure as exists in the generator. The falling liquid from the percolator is prevented from entering the float by a shield, which serves to disperse it, and keeps it from contact with the open part of the float. The gas produced in the generator is pumped into the purifier, where it is passed through water, and from which is supplied to the expander by a double plunger pump of a peculiar construction. The expander is surrounded by a jacket in which steam, hot air, or hot water is caused to circulate, and the pressure of the gas is thereby much increased, or the use of a current of electricity may be adopted for the same purpose.

From the expander the gas passes to the cylinder of the engine, where it actuates a piston in precisely the same manner as steam is caused to act on the piston of a steam engine. After performing its duty in the cylinder, the carbonic acid is passed through a vessel, containing in solution some chemical substance, capable of combining with it to form a material, which on being concentrated or evaporated to dryness, may be again used in the production of carbonic acid gas. Those portions of the apparatus which are liable to be corroded by the acid employed, are to be protected by a covering of gold or platina, or to be formed of those metals. With the same view the interior of the generator is lined with sheet lead.

Although sulphuric acid and carbonate of soda are the substances which the patentee prefers to use for producing gas for the purposes of his invention, he does not confine himself thereto, but uses bicarbonates and sesqui-carbonates of soda and carbonates of other alkalies, and other acids than sulphuric, as also substances with an acid reaction; the object which he has in view being to obtain at the same time with the production of gas residuary materials of commercial value. Thus from sulphuric acid, and carbonates of soda, potash or ammonia, are obtained residual sulphates of those bases; from nitric acid with the same bases valuable nitrates; from boracic acid and soda, the borax of commerce; from alum, with potash or soda, valuable fertilizing salts; from chromic acid and potash, chromate of potash, a compound valuable in dyeing; and from hydrochloric acid and ammonia, sal-ammoniac of commerce. These however are merely given as examples.

Claims.—1. The employment of the specified materials when corrosive acids are used, in the construction of the pumps and other parts of the apparatus.

2. The use of a percolator whereby the materials forming the gas, are more intimately mixed together by passing through a more extended surface.

3. The self-acting float valve, whereby the residuary matters collected at the bottom of the generator are discharged from time to time.

4. The purifier, whereby the carbonic acid gas is purified before being used, to prevent any injurious effect on the engine.

5. The pumping the gas into the expander to increase its pressure by the action of heat previous to its being used in the engine, whereby greater economy is obtained in the consumption of the gas.

6. The heating and expanding of the gas for the last-mentioned purpose by means of electricity.

7. The construction of a double plunger pump, which requiring no valve is particularly adapted for all aëriform and gaseous fluids, which require to be compressed or condensed under strong pressure, the mechanical arrangements of which are above described.

Henry Briggs, of Primrose-street, Bishopsgate-street, seed-crusher. *For improvements in oil lamps and in apparatus for lubricating.* Patent dated October 9, 1851.

The "improvements in oil lamps" have relation to the Argand lamps employed for the roofs of railway carriages, and consist in regulating the admission of air to the wick by means of a perforated plate of metal or wire gauze.

The "improvements in lubricators" consists of two arrangements for lubricating the axles of carriage wheels. In the first of these, the bearing part or neck of the axle is formed with a collar at the centre of its length, which by dipping into oil contained in a reservoir formed in the lower part of the axle box, and immediately below the neck of the axle, raises the oil and allows it to descend so as to keep the rubbing parts always supplied. In this arrangement the brass bearing of the axle is divided into two parts one on each side of the collar. In the second arrangement, the collar to the neck of the axle is dispensed with, and a hollow roller is used, which floats in the oil reservoir in contact with the under side of the neck of the axle. The revolution of the axle causes the roller also to move round, and bring up oil on its surface which is thus raised by the axle and the rubbing parts kept constantly supplied.

Claims.—1. The mode of regulating the admission of air to Argand lamps for railway carriage roofs by means of perforated plates or wire gauze.

2. The means whereby the oil is raised from a vessel below the axle, and supplied to the rubbing surfaces by a collar formed on the axle or by a roller as described.

Sir John Scott Lillie, Knight Companion of the Most Honourable Order of the Bath, of Pall-mall. *For improvements in forming or covering roads, floors, doors, and other surfaces.* Patent dated October 9, 1851.

For forming or covering roads, floors, and such surfaces, the patentee employs a combination of metal with coarse gravel, broken stone, and asphalt or bitumen. The metal

is employed in the form of pegs, which are inserted in an already-formed road or attached to a plate of metal, and the intermediate spaces are then filled in with the ordinary road-making materials.

For constructing doors and party-walls, the patentee connects together two plates of metal with projecting pieces attached thereto, and fills in the intermediate space with a mixture of materials, as above mentioned.

Another method of constructing walls where great strength is required, consists in using blocks of concrete, to one side of which is attached a plate of metal. The blocks are so built together as to have the plates outermost, to form the faces of the wall.

Claim.—The composition of materials described for forming or covering roads, floors, doors, and other surfaces.

HUBERT SOMMELET, of PARIS. *For improvements in the manufacture of scissors.* Patent dated October 10, 1851.

These improvements consist in the manufacture of scissors by cutting and stamping. The parts constituting a pair of scissors are first cut by a machine, provided with suitably-shaped punches, from a sheet of steel; they are then forged and stamped to the exact shape required, and are afterwards finished by polishing in the usual manner For the purpose of finishing the interior of the rings, the patentee makes use of a small grooved roller, the grooves of which are roughened like files, some being coarse and others fine. This roller he introduces inside the ring, and then, by causing the roller to revolve, and bringing the interior of the ring in contact with the coarse and fine grooves successively, it is reduced to the exact size and polished also. For the purpose of producing a better finish than is obtained by the use of the file surfaces, a small wooden roller is employed, which, being set in revolution in a lathe, acts by friction on the interior of the ring, which is slipped over it for the purpose. The dies used in the stamping process are produced by impressing soft steel with a die having in relief the form of the scissor-blade to be manufactured. The soft steel dies are then hardened for use, and by this means any quantity may be produced from a single counterpart.

Claims.—1 and 2. The application and use of a cutting machine and of stamping machines fitted with dies in the manner and for the purpose described.

3. The mode of forming the dies described.

4. The application and use of grooved steel rollers, with roughened surfaces for the purpose described.

5. The application and use of a small wooden roller for the purpose of more effectually polishing the interior of the rings of scissors.

JOHN FEATHER, of Keighley, worsted spinner and manufacturer, and JEREMIAH DRIVER, of the same place, iron and brass-founder. *For certain improvements in screws.* Patent dated February 9, 1852.

These improvements have relation to the screws used for propelling wool and other fibrous materials through combing and preparing machinery. Such screws, as used in conjunction with gill combs, are generally made of uniform pitch throughout their length, and from their giving an equal speed to every part of the material which they act on, do not efficiently keep both the long and short fibres in their proper places to be worked by the combs, when the combs are fine, the long fibres being drawn over instead of through the teeth, and when the combs are coarse, the short fibres being drawn through the teeth without being effectually combed. Now the patentees propose to construct the screws with a variation or variations in pitch at different parts of their length, so that when at work both the long and short wool shall be held in their proper places to be combed, which result will be found to arise from the variation in speed produced by the varied pitch on the screws.

Claim.—The manufacture of screws with a variation or variations in pitch, so that the pitch of such screws shall be coarser at any one part of their length than at any other part.

Specification Due, but not Enrolled.

THOMAS TAYLOR, of the Patent Saw Mills, Manchester. *For improvements in apparatus for measuring water and other uids.* Patent dated October 9, 1851.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Charles William Siemens, of Birmingham, engineer, for an improved fluid meter. (Being a communication.) April 15; six months.

François Joseph Beltzung, of Paris, in the Republic of France, engineer, for improvements in the manufacture of bottles and jars of glass, clay, gutta percha, or other plastic material, and caps and stoppers for the same, and in machinery for pressing and moulding the said materials. April 15; six months.

Edwin Pettitt, of Kingsland, Middlesex, civil engineer, and James Forsyth, of Caldbeck, Cumberland, spinner, for improvements in machinery for twisting, drawing, doubling, and spinning of cotton, wool, silk, flax, and other fibrous substances. April 15; six months.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements for preventing the incrustation of steam boilers, which invention is also applicable to the preservation of

metals and wood. (Being a communication.) April 15; six months.

Charles Seely, of the City of Lincoln, for improvements in the manufacture of flour. April 15; six months.

Thomas Ellwood Horton, of Priors-Lee-Hall, Salop, iron-master, and Elisha Wylde, of Birmingham, engineer, for improvements in apparatus for heating and evaporating. April 15; six months.

Simon Davey, of Rouen, France, merchant, and Adolphe Ludovic Chann, of Paris, France, merchant, for improvements in explosive compounds and fusees, and also in methods of firing the same. April 15; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
April 7	3206	F. Somner	Kelso, North Britain	Stack or rick ventilator.
,,	3207	W. Hughes	Manchester	Typograph for the blind.
8	3208	E. A. Baker	Whitechapel-road	Improved gun lock.
10	3209	J. Collins	Birmingham	Safety lever bolt.
,,	3210	E. Poulson	Sunderland	Reverse levers for shipping.
,,	3211	J. Atkin	Huntingdon	Crutch elastic.
,,	3212	W. Weild	Manchester	Pipe cutter.
,,	3213	J. Howard	Berners-street	Circular extending and oblong dining table.
14	3214	J. Fletcher and Co.	Glasgow	Duplex reversable and expanding cap.
,,	3215	J. Brooks	Birmingham	Clog.
,,	3216	O. L. Detouche and E. Brisbart	Castle-street, Holborn	Electro-magnetic clock.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

April 3	390	W. Wellby	Bermondsey	Life buoy.
8	391	W. and C. Clay	Broad-street, Golden-square	Projectile.
,,	392	G. Hull	Peckham	Lamp glass or shade.
10	393	J. C. Gunn	Edinburgh	Collar for connecting pipes.
,,	394	E. Poulson, Sen.	Sunderland	Pendulum lever pump break.
14	395	G. Fletcher & Co.	Wolverhampton	Portable bedstead.
,,	396	P. A. Fontainemoreau	South-street, Finsbury	Self-indicating altimeter.
,,	397	J. Gedge	Wellington-street, Strand	Self-opening umbrella or parasol.

CONTENTS OF THIS NUMBER.

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Edited by J. C. Robertson, 166, Fleet-street.

FROMINGS' PATENT FORGE-HAMMER.

Fig. 3.

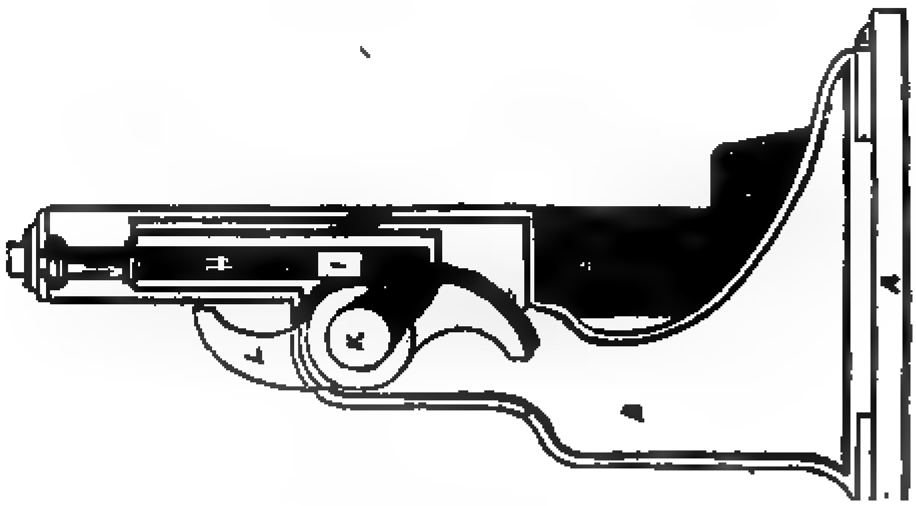

Fig. 2.

Fig. 1.

FROMINGS' PATENT FORGE-HAMMER.

(Patentee Mr. Thomas Henry Fromings, of the firm of Lomas, Fromings, and Co., of Sheffield. Patent dated October 16, 1851. Specification enrolled April 16, 1852.)

Specification.

My improvements in forge hammers consist in so constructing them that they may be applied to all kinds of forging with much greater facility and economy than the power-driven hammers hitherto in use; and further, in rendering them more suited for forging many smaller articles which are now entirely forged by manual power applied directly to the shaft of the hammer. Fig. 1 is a perspective view, fig. 2 a front elevation, and fig. 3 a side elevation of a forge-hammer constructed according to my said improvements; A A is a basement plate mounted upon large ashlar stones, under which oak beams are laid, the whole being fixed together by holding-down bolts; B B are standards, forming a general framework by being bolted at their lower ends to the base-plate, and at the upper ends to a crosshead or rail C. D is the anvil block, which is fixed on a block of wood; E the anvil; and F the hammer, fixed to the hammer-head G. H is an upright guide-rod, to the lower end of which the hammer-head is securely keyed; the upper end of the guide-rod H works through a brass in the top rail C. I is a crosshead, which is securely fixed to the guide-rod H, and works freely up and down in slots formed in the side frames, through which it passes, and beyond which it projects a short distance on both sides. K is a driving-shaft, which has its bearings in brasses mounted in the framework. L L are cams affixed to the driving-shaft, which, when the shaft is made to revolve, come against the projecting ends of the crosshead I, and raise it, together with the hammer-head and hammer. As soon as the cams pass the cross-head, the hammer drops. The cams are represented in the engravings with two rises or arms upon them, but it will be evident that they may have any number of rises, or be even reduced to a single rise, dependent upon the speed at which the hammer is to be worked and the amount of power at disposal for working it.

When the hammer is to be driven very fast, then I attach a helical spring to the cross-rail C and around the guide-rod H. When the hammer is raised, the spring is compressed between the cross-head I and the rail C; and on the cross-head being released from the cams, the spring assists in accelerating the descent of the hammer, and materially increases the force of the blow. For the helical spring, springs of any other form may be substituted. The power employed to work this hammer is applied to the driving shaft K by means of any suitable mechanical contrivance, and may be derived from any prime mover, such as steam, water, or even manual labour. It will be seen, from the above description of my improvements in forge-hammers driven by power, that they are for the first time made applicable to a lighter class of forging, such as edge tools, files, knives, &c., besides being more conveniently, and with less cost, applicable for heavy forging.

And having now described my said invention, and in what manner the same is to be performed, I declare that what I claim as of my invention is the improved forge-hammer, before described, in the general arrangement, combination, and adaptation of parts of which the same consists; that is to say, in so far as regards the employment of cams attached to a revolving shaft to actuate the cross-head affixed to the guide-rod of the hammer; and also of springs, to increase the force of the hammer, as above described.

A NEW EXPLANATION ATTEMPTED OF THE PRESSURE OF FLUIDS AND FORMATION OF STEAM.

It is well known that the pressure and velocity of fluids increase in the same proportion, and are governed by the same laws, as the accelerated motion of falling bodies. The pressure against the whole side varies as the square depth of the vessel. By way of illustration a very elegant experiment may be cited, which has been rendered familiar to the scientific world by means of *clepsydræ*, or water-clocks. The following laws of the pressure and velocity of fluids have been experimentally proved by such instruments:—*That the pressure against*

the sides is as the square of the depth; but that the velocity of a jet, or spouting pipe, which depends on the pressure at the orifice itself, is as the square root of the depth.

We are not aware, that the almost obvious reason we are about to assign for this remarkable law, has even been previously given, excepting in one instance; we met with it in one of the scientific works of the celebrated Swedenborg. This eminent philosopher assigns a similar atomic arrangement to water as Dr. Dalton, which he designates the fluid or quadrilateral position of atomic particles. In this arrangement, *one atom rests upon four others:* this is equally the case in a vertical as in a lateral direction. Both these philosophers agree in this being the structural arrangement of the atoms of water. But the former alone pursued the conception to its ultimate result, viz., the development of the law of pressure and motion of fluids.

By way of illustration, let us cite the elegant experiment which a water-clock furnishes as an illustration of this law. Let the vessel be of sufficient size and depth to take *ten hours* to empty itself through an orifice at the bottom of the vessel. In such a case the vessel must be divided into 100 parts. The *spaces* described by the descending surface of the fluid, in equal portions of time, are as the odd numbers, 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, taken backwards. Hence the pressure is as the square of the depth, or as the numbers 1, 4, 9, 16, 25, 36, 49, 64, 81, 100. Now it is evident, that *the pressure in a lateral direction is as the column of atoms in the same direction, and this column is precisely the same as the above numbers.* For one atom presses upon 4 others, and these upon 9, and these again upon 16, and so on as above given. So that the pressure of atoms one upon the other is exactly as follows, 1, 4, 9, 16, 25, 36, 49, 64, 81, 100. This renders the law of pressure in fluids self-evident; whilst it renders equally manifest the law of velocity being as the square root at the orifice of the pipe, or jet.

Another proof that this law of pressure depends on the structural arrangement of the atoms, is furnished by the fact, that at the point of greatest density of water the atoms take another arrangement, and the volume of water sinks. Now, at this point of greatest density, this law of pressure also ceases: so that beyond this point the law of pressure is changed. I am of opinion that this is the true cause of the law of expansion for fluids; viz., as the square of the temperature: and I think this law is only uniform up to the point of greatest density, after which it also changes. So that, I think, both the law of pressure, and the law of expansion, for fluids, are founded upon this quadrilateral arrangement of the atomic particles of water; that these laws act uniformly up to the same point,—viz., the point of greatest density; after which the atomic arrangement changes, and with it the laws of pressure and of expansion change also. But this variation is so slight for low temperatures as to be almost imperceptible. The admirable researches of Dulong and Petit (Annales de Ch. et de Ph. vol. vii.), prove that the uniformity of the law does not hold good: but that *within the range of low temperatures* the variation is so inconsiderable as to escape observation. Dalton held the opinion that the law of expansion for water, being as the square of the temperature, *held good from the point of greatest density upwards:* we, on the contrary, hold the opinion, that the law *holds good up to the point of greatest density and then changes.* Dalton begins to apply the law at the very point we contend that it changes.

Let us now see how far the geometrical structure of water will explain the phenomena of temperature, latent heat, &c., of water and steam.

New Theory of the Latent Heat of Boiling Water and Steam.

Water has a definite arrangement of its particles, wherein, as Swedenborg and Dalton affirms, "each particle rests upon 4 particles below." A volume of such matter has the following proportions:—

1. The space of the volume is to the globular space occupied by the atoms, as 3 to 2, or as 6·1 to 4·1.

2. The space of the volume is to the interstitial space between the globular atoms, as 3 to 1, or as 6·1 to 2.

3. The globular space of the atoms is to the interstitial space, as 2 to 1, or as 4·1 to 2.

Now, we have reasons for believing that at the point of greatest density, this arrangement is changed to the vertical position of atoms, wherein one atom rests upon the top of another, or wherein they are arranged side by side. This vertical position of atoms necessitates other proportions than those which prevail above in the quadrilateral, or ordinary position.

1. The space of the volume is to the interstitial space between the globular atoms as 21 to 10.

2. The space of the volume is to the globular space of the atoms as 21 to 11.

3. The globular space of the atoms is to the interstitial space as 11 to 10.

The first proportions are for water as its ordinary temperature, 32° Fah. The latter proportions are for water from the point of greatest density to the boiling point. Now the latent or interstitial heat of water is equal to 140 degrees, and the sensible or superficial heat is 32 degrees. Hence we are furnished with the following ratios: the latent heat of water in the quadrilateral position, or below the point of greatest density, is to the latent heat of water in the vertical position, or above the point of greatest density, as the values of the one position are to the other, or $\frac{6 \cdot 1}{4 \cdot 1}$ to $\frac{21}{11}$, or as 1·480 to 1·909; which give:

$$1 \cdot 480 : 1 \cdot 909 :: 140° : 180°.$$

Hence it follows, that the vertical position would be assumed by the atomic particles, the instant 180° had been accumulated. This would occur when the sensible or superficial heat had attained to 40°, or thereabouts; which, with the latent, 140°, would make $40° + 140° = 180°$. But as 180° form the latent heat required for the interstitial spaces of the atoms, and 32° form the sensible heat, it follows that the boiling point of water is simply the bringing into activity all the latent heat or $32° + 180° = 212°$. Hence, when the sensible heat increases from 32° to 40°, the expansive power of the temperature becomes able to break up the atomic arrangement, thereby gradually setting at liberty the latent or interstitial heat of 140°. As this new position requires 180° of interstitial heat, besides 32° of sensible heat, we see the reason why 212° is the boiling point of water: because the whole of the interstitial heat has become active or sensible. After the vertical position is broken, wherein one atom rests upon another, it is impossible for them to exist together, any further expansion must necessarily rend the atoms asunder; so that vapour must now be formed.

That the point of greatest density is at, or near to 40°, is evident from the following ratios: as the latent or interstitial heat of water (140°) + the sensible heat (32°), is to the ordinary temperature at which it began to get its latent heat, so is the interstitial heat of water above this point + the sensible heat, to the temperature at which *it also began* to get its latent or interstitial heat; or as follows:—

$$140° + 32° = 172° : 32° :: 180° + 32° = 212° : 39°44.$$

So that 39°·44 is the point of greatest density, where the law of expansion changes from the square of the temperature.

This law of atomic arrangement will as satisfactorily account for the latent heat of *steam* as of water: the following ratio will give it. As the point of greatest density, or, what is the same, the point at which the interstitial heat of water changes, is to the interstitial heat subsequently attained, so is the point at which the change again takes place, to the interstitial heat which is again attained; or as follows:—

$$39° \cdot 44 : 180° :: 212° : 967°.$$

So that 967° is the interstitial or latent heat for steam. Hence the *first change* takes place at 31° of sensible heat, the expansive force of which arranges the particles of water into the quadrilateral position, thereby enabling them to take in 140° of interstitial heat. The *second change* takes place at 39°·44 of sensible heat, the expansive force of which arranges the particles into the vertical position, thereby enabling them to take in 180° of interstitial heat. The *third change* takes place at 212° of sensible heat, which enables the particles to take in 967° of interstitial heat, thereby forming steam.

The computations agree with the best experiments. Dr. Hope believes the

greatest density of water to be between 39°·5 and 40° Fah. According to Mr. Hallstroom, whose experiments appear to have been conducted with very great care, the maximum density is given at 39°·39 Fah. (Ans. de Ch. et Ph. xxviii. 90). These estimates differ very little from our own, or 39°·44. As for the estimate given for the interstitial heat of steam, our calculation gives the same as that given by Dr. Ure, or 967°.

S. Beswick.

Manchester.

ON THE FRICTION OF MARINE ENGINES. BY J. V. MERRICK.

In the calculations deduced from experiments for ascertaining the power employed in the propulsion of steam vessels, it is important to determine the loss in utilized effect, resulting from the friction of the engine. This loss has been variously stated by different authors; who have, however, so far as I am aware, given only approximate estimates, without calculating it from known data. Exact results cannot, it is true, be obtained, because the condition of the "journals," or rubbing surfaces, varies so constantly, whether from improper keying up, or imperfect lubrication, that the same engine would give very different coefficients at different times. It would, however, be interesting to inquire what is the friction incident to a normal state of affairs, and upon that basis, make allowances according to the circumstances of any special case.

The losses consequent upon friction may be stated as follows:—1st. The friction on the rubbing surfaces depending on the weight. 2nd. The friction and resistance of the air to the moving parts; these, with the force required to work the air and feed-pumps, and the valves, with the friction of these forces, make up a sum, which expresses what is called the "power to work the engine without load." If to this we add, 3rd, the friction of the load put upon the engine, we shall have expressed all the deductions to be made from the gross power developed by a marine engine, in order to find that transmitted to the wheels or propeller.

Of these causes of loss, the (2nd) resistance of the air to the moving parts, is too trifling to enter into a calculation of practical value. That of the air-pump varies, of course, with the head against which the waste water is discharged, with the vacuum attained, &c.; but as an average for marine side-lever engines, upon which form the present calculation is based (when steam is expanded two to three times), it has been found by indicator diagrams to vary from 6 lbs. to 7 lbs. per square inch of area of the air-pump. When the latter has a capacity of one-fifth the cylinder, the resistance in pounds per square inch of cylinder piston would be

$$r = \frac{(6+7)\times \cdot 20}{2\times 2} = 0\ 65\ ;$$

since the air-pump piston makes but one working stroke, while that of the cylinder performs two. If the ratio of capacities be ·22, then

$$r = \frac{6\cdot 5\times \cdot 22}{2} = 0\cdot 715,$$

and if ·24, then

$$r = \frac{6\cdot 5\times \cdot 24}{2} = 0\cdot 78\ ;$$

if only ·18,

$$r = \frac{6\cdot 5\times \cdot 18}{2} = \cdot 585.$$

Hence it may be stated in general terms, that the mean resistance caused by the air-pump is $\frac{7}{10}$th pound per square inch of the steam piston.

The friction of journals was found by Morin ("Leçons de Mécanique Practique," 1re Partie,) to be unaffected by the velocity and extent of surface, and dependent simply on the pressure. The coefficient is stated to be ·05 the pressure when lubrication is constantly applied, and ·075 when it is renewed from time. As the latter is generally the case, we shall employ that coefficient.

The power required in a given time to overcome the friction of any journal, will therefore be the product of this coefficient, by the mean pressure exerted upon it, and by the distance passed over by a point in the circumference of the journal during that time. Hence, the greater the diameter of a journal, other things being equal, the greater will be the friction, because with the same angular motion a point in the circumference passes over a greater distance.

In calculating the friction without load, I shall take for an example a side-lever engine of 72-inch cylinder, 8 feet stroke, of which I have the weights; a similar process may be applied to any other description of engine with equally correct results.

In this instance, if D represents the diameter of the cylinder, that of the main shaft journals is 0·2 D; outboard journals, 0·14 D; crank pins, 0·125 D; end beam pins, 0·084 D; air-pump beam pins, 0·06 D; side-lever centres, 0·167 D; the angular motion of the side-lever during a double stroke is 0·28 × circumference; hence the distances passed over during that time will be respectively—end beam pins, ·28 ×

3·1416 × ·084 D = 0·074 D; main journals, 3·1416 × ·2 D = 0·63 D; outboard journal, S = 0·44 D; crank pin = 0·39 D; side lever centre = 0·145 D; air-pump beam pins = 0·053 D.

The weights in round numbers are, on the outboard journals, 62,000 lbs., main journals, 31,000; crank pin, 4,000; cross-tail pins, 12,000; side-rod pins, 16,000; air-pump pins, 6,000, and on the side-lever centres, 56,000. The friction of weight will therefore be (remembering that D = 6 feet).

				lbs.	lbs.
Main journals............	·075	× 31,000	× ·63	D = 8790	
Outboard journals	"	× 62,000	× ·44	" = 12276	21,066
Crank pin, weight........	"	× 4,000	× ·39	" = 702	
" " previous friction	"	× 21,066 ÷ 16	× ·39	" = 232	934
Cross tail pins, weight	"	× 12,000	× ·074	" = 400	
" " previous friction...	"	× 2,000 + 16	× ·074	" = 46	446
Air-pump pins, weight	"	× 6,000	× ·053	" = 138	138
Side rod " "......	"	× 16,000	× ·074	" = 533	
" " previous friction..	"	× 2,446 + 16	× ·074	" = 47	580
Side lever centres, weight..	"	× 56,000	× ·145	" = 3660	
" previous friction	"	× 44,992 + 16	× ·145	" = 184	3,844
Whole friction for a double stroke					27,008

Therefore, the power required to be developed by the engines = area of cylinder × twice stroke × x, = 27008, and x = pressure in pounds per square inch of piston

$$= \frac{27,008}{4071 \times 16} = 0·36,$$

or, allowing for imperfect lubrication, say one-half pound.

To this must be added the friction of packing in the cylinder and pumps—an element very difficult to fix upon, as it depends entirely on the description and condition of the packing employed. In the absence of direct experiment, observation induces me to believe that this friction in well-kept packing does not exceed from one-half to one pound per square inch of rubbing surface, which, on a 72-inch cylinder, with rings 5 inches deep, would amount to from 615 to 1230; in that case, the area of piston being 4071, the pressure required would be

$$\frac{615}{4071} \text{ to } \frac{1230}{4071} = 0·15 \text{ to } 0·30 \text{ lbs.}$$

For the air-pump, the same assumption would give per square inch of its area, 0·22 to 0·43, which, by ·21 (ratio of capacities) = 0·046 to 0·092 lbs. on the steam piston. Finally, the friction of the power required to work the air-pump is almost inappreciable (about $\frac{1}{400}$th of a pound per square inch), and may be neglected without serious error.

Summing up these elements, we have—

1.	Power to work the air-pump	0·585	to 0·780
2.	Friction of weight........................	0·500	" 0·500
3.	" cylinder packing	0·150	" 0·300
4.	" air-pump packing..............	0·046	" 0·092
5.	Power to work balance valves, Friction of parallel motion.. Resistance of the air, &c..... } .... say	0·169	" 0·178
	To work the engine without load......	1·450	" 1·850

$$\text{Mean} \frac{1·450 + 1·050}{2} = 1·65 \text{ lbs.}$$

per square inch. If the journals were kept constantly lubricated, as is the case when automaton lubricators are employed, the friction of weight would be only

$$\frac{·50 \times ·05}{·075} = ·33,$$

and the pressure would be reduced to 1·65 − ·17 = 1·48 lbs. per square inch. It therefore appears to me that 1·75 and 1·50 lbs. would be a just allowance in these two cases respectively.

There now remains to be considered the value of the friction of any load which may be put upon an engine of this description. It would be a tedious operation to obtain this with perfect accuracy, because, beginning at the cylinder with a given pressure, the friction of the several parts would gradually diminish it, until, arriving at the shaft journals, it would be less by the whole friction of the engine. But it may be found with sufficient exactness for our present purposes as follows:

Calling P = the mean pressure on the piston, over and above that required to work the engine without load, and A = the area of the cylinder in inches, then, as D = 6 feet,

Friction on side rod pins........ =	$\cdot075$ AP $\times$ 0·74	D =	·0333 AP
" crosstail pins ...... =	AP $\times$ 0·74	"	·0333 "
" side lever centres.... =	2 AP $\times$ 0·145	"	·1305 "
" crank pin.......... =	$\cdot\frac{8}{14}$ AP $\times$ 0·39	"	·1118 "
" main journals ...... =	$\frac{8}{14}$ AP $\times$ 0·63	"	·1813 "
Total friction during a double stroke			4902 "

But as the whole power developed in this time is AP $\times$ 2 S (S = 8) = 16 AP, therefore,

$$\frac{\cdot4902}{16} = 0\cdot0307,$$

the proportion of the whole power employed in overcoming friction of load, or if automaton lubricators be used,

$$\cdot0307 \times \frac{\cdot05}{\cdot075} = 0\cdot0205,$$

or two per cent. When it is recollected that this calculation is based upon perfect keying up, and proper lubrication, points which are generally not so well looked to as they should be, it does not appear that 4 and 5 per cent. respectively are far from the true value of friction in ordinary cases.

The friction of any other form of engine might be calculated in the same manner, and I think a comparison would show that the side lever engine is not *quite* so much behind some others in this point of view as has been commonly supposed. — *Franklin Journal.*

THE STEAM-FRIGATE "BIRKENHEAD."—IRON v. WOOD.

(From the *Liverpool Albion.*)

Considerable interest being excited as to the melancholy loss of the steam-frigate *Birkenhead*, we have endeavoured to collect some particulars of her construction, of the various services she has been engaged in, and of the circumstances attending her shipwreck. She was built by Mr. Laird, of *Birkenhead*, and launched in 1845; and the following extract of a letter addressed by that gentleman to the *Times*, April 12, 1849, gives some details as to the circumstances under which the Admiralty originally ordered her :—

"On the successful trial of the *Guadaloupe*, I was called upon by the Admiralty to supply plans and a tender for the construction of a steam frigate of the first class; and, to guide me in designing her, I applied for and was furnished with the following statement of the weights she would have to carry; namely:

	Tons.	Cwt.
"Masts, yards, rigging, sails, cables, anchors, and stores	99	12
Water, provisions, crew, and effects	86	18
Guns, powder, and shot	59	4
Coals for 12 days	420	0
Engines 378-horse power	342	0
	1,007	14
Estimated hull for an oak ship......	750	0
Displacement required for the oak ship, at 15·6 mean draught........	1,757	14

"The designs I submitted, and which were finally approved, were of a vessel 210 feet long (being about 20 feet longer than any vessel of her class had been built), and 37·6 beam, with a displacement of 1,918 tons on the load water-line of 15·9. The only change made by the authorities at the Admiralty in these designs was in the position of the paddle-shaft, which they ordered to be moved several feet more forward; the change was unfortunate, as it makes the vessel, unless due care is taken in stowing the hold, trim by the head. With this exception, I am answerable for the model, specification, displacement, and general arrangement of the hull of the vessel. The *Birkenhead* was launched in 1845. Her hull was at that time complete, with the exception of some cabin fittings, estimated at 15 tons. Her launching draught was 9 feet 9 inches, showing the weight of the hull to be 903 tons; leaving for the machinery, stores, &c., given to me at 1,007 tons 14 cwt., 1,000 tons. If these weights had not been exceeded, the vessel would have gone to sea within 1 inch of her calculated draught—say 15 feet 9 inches.

"The *Birkenhead* was never tried as a frigate. Before she was commissioned it was taken for granted that iron frigates would not answer, and her destiny was altered to a troop-ship, a poop added to her, and she is loaded with coals and stores generally to 2 feet beyond her intended load waterline. With all these disadvantages, I am informed by those who have sailed in her, that she is a fast and remarkably easy vessel, and I have no hesitation in saying that, if loaded only with the weights for which I was directed to construct her, she will not be excelled in speed and seagoing qualities by any steamer, private or public, of her size and power.

The *Birkenhead* was constructed (under the immediate inspection of Mr. D. G.

Banes, of Chatham Dockyard) of great strength in thickness of plates and size of *frames*, &c., as the following statement of the comparative weight of the hulls of several large steam frigates conclusively shows; oak and teak-built vessels, such as those the comparison is made with, being generally much heavier than iron vessels :—

Name.	Builder.	Iron or Wood.	Tonnage, O. Rule.	Weight of Hull when launched.
Birkenhead	Laird	Iron	1,400	903 tons.
Megæra	Fairbairn	Iron	1,395	743 ,,
Vulcan..........	Mare	Iron	1,764	1,000 ,,
Terrible	Dockyard........	Wood.......	1,850	1,130 ,,
Sampson	Ditto	Wood.......	1,299	730 ,,
Retribution	Ditto	Wood.......	1,641	1,217 ,,
Mozuffer	East India Comp. .	Wood.......	1,440	991 ,,

The *Birkenhead* was completed and fitted with engines of 564-horse power by Messrs. G. Forrester and Co., and left this port in 1846, and on her passage to Plymouth was reported by the officer in charge to have made 12 to 13 knots on her passage round. She was at this time in fair trim, not being fitted with the heavy poop and forecastle afterwards added to increase her accommodation as a troop-ship. For sometime she was laid up, but eventually commissioned by Captain Ingram, and employed in various ways on the coasts of England, Ireland, and Scotland, and towed the *Great Britain* from Dundrum Bay to Liverpool. Her next employment was carrying troops to the Channel Islands, Lisbon, &c.; which services she was considered to have performed very satisfactorily, making some remarkably quick runs. She was commissioned in 1850 by Commander Salmond, and has since been to Halifax, Cape of Good Hope, &c.; her last run from Halifax to Woolwich was made in 13½ days, with a large number of troops on board, and, by a judicious arrangement of only working one boiler and the engines expansively, Captain Salmond was enabled to steam long distances with very small expenditure of fuel.

Her speed may be best tested by her passage to the Cape last year, with troops, as contrasted with other vessels in the Navy sent on similar service :—

	Days.
Birkenhead	45
Vulcan..................	56
Retribution	65
Sidon	64
Cyclops	59

And her return home in October was made in 37 days, including stoppages. Her last passage out occupied 47 days, having left last January, during very bad weather. The *Megæra*, that sailed about the same time, had been 54 days out, and had not arrived when the last Cape mail left.

On the whole, her performances prove her to have been the fastest, most carrying, and comfortable vessel in Her Majesty's service as a troopship, and one that could be fully relied on both in hull and machinery. The Admiralty appear to have taken every precaution to keep her in efficient condition, as she was docked on her return from the Cape in October, 1851, and her hull examined and reported in perfect order; her machinery was improved, with a view of economizing fuel; and, on her trial at Spithead, after this refit, she made, with 400 tons of coal, 60 tons of water, and four months' stores on board, fully 10 knots per hour.

All accounts from the survivors of the *Birkenhead's* melancholy loss agree in one respect, that the cause of the accident was striking upon a sharp-pointed rock, going at a speed through the water of eight and a half knots; and when we consider that her weight or displacement at her load draught, as a troop-ship, was upwards of 2,000 tons, the effect of such a blow may be readily imagined. The *Birkenhead* was divided into eight watertight compartments, by athwartship bulkheads; and the engine-room was subdivided by two longitudinal bulkheads into four additional compartments, forming the coal-bunkers; making in all twelve watertight sections.

The first blow (from the description of Captain Wright and other survivors) evidently ripped open the compartment between the engine-room and fore peak, and to such an extent that the water instantaneously filled it, as stated by the engineer, Mr. Renwick; and the next blow stove in the bilge of the vessel in the engine-room, thus filling the two largest compartments in the vessel in four or five minutes after she struck. Had she been a wooden vessel, or not built in compartments, she must have

gone down, like Her Majesty's steam frigate *Avenger*, in five minutes after she first struck. As it was, the buoyancy of the after compartment alone was the means of giving time to get the boats out, and saving most of those who were rescued from death.

Eventually the long swell, and at least 1,000 tons weight of machinery, coals, &c., amidships, acting against the buoyancy of the after division, caused her to break off as described, and sink in deep water. The case appears to be parallel with the *Orion's*, the sides and bilge having in both instances been ripped open in the forward and engine-room compartments.

The case of the *Nemesis* striking on the rocks off St. Ives, ten or twelve years ago, was somewhat similar, excepting that she ran stem on, and consequently only damaged her fore-foot, and admitted the water into her foremast small compartments.

Many other accidents have happened, proving the vast superiority of iron vessels in cases of grounding, and, in proof of this we may, in conclusion, quote the evidence given by Mr. A. F. B. Creuze, Chief-surveyor of Lloyd's, before the Committee on Army and Navy Estimates of 1848 :

"Are there any points in which, in your opinion, iron has an advantage over wood as a material for building ships ?—It has, from the before-mentioned reasoning, the advantage of greater lightness combined with the same quantity of strength, or more strength combined with equal lightness ; you may consequently build a better formed ship of iron ; you may take advantage of its comparative lightness to build a ship of a better form. The expenses of the repair of iron is exceedingly trifling compared with the expense of the repair of wood, and the facilities for repair extraordinary. There are two or three remarkable instances of this on record. There is the *Nemesis*, one of the vessels of which I spoke, which went out to China. When she was passing round the Cape she encountered a gale of wind, and she literally split down ; she was run on shore and repaired by her crew in a very short space of time, and went to sea again, and they went with her straight to the China war. The *Phlegethon* ran on a rock ; she knocked a hole in her bottom that was 12 feet in length. I saw a letter from the commander to say he could walk in and out of it. In ten days she was repaired and fit for all purposes by the crew alone. That would have been perfectly impossible with a timber-built ship. The *Nemesis* ran upon a rock off the Scilly Islands, in going from Liverpool to Odessa; she put into Portsmouth ; she had knocked a hole in her stem ; she was repaired at an expense of 30*l.*, though Mr. Laird had to send for the workmen from Liverpool to do so.

"If a wooden vessel had struck in the same way, do you think she would have gone down ?—Decidedly so."

GOOD TOOLS AND GOOD MATERIALS.

A notion prevails that machine tools are only advantageous when on a large scale, and when worked by a steam engine or other inanimate power, but the observations in Professor Willis's lecture of 28th January last will, it may be hoped, cause "machine tools" to be "introduced into workshops of a smaller character than at present, in the same manner as the lathe." The professor informed his audience that, "In America, a variety of contrivances are employed in workshops to facilitate and give precision to ordinary operations—as, for example, the foot mortising machine for wood. The earliest contrivance of this useful tool (the offspring ot Bentham's mortising machine)," &c.

In furtherance of the professor's recommendation, it may be usefully called to mind that all of Bentham's machines at Queen-square Place for working stone, ivory, wood, &c., were devised and made with a view to their employment by *unskilled* men—convicts—without any other motive power than their own force applied to the turning of an axis. Further, the machines and engines there exhibited to so many persons of all ranks, were worked by the force of man alone ; the whole of the apparatus for making every part of a window-sash, and that for carriage wheels, inclusively.

So also it was by the force of man alone that the General's engines were at first worked in Portsmouth Dockyard. There was no other motive power applied when others of his machine tools were for several years constantly employed in the house-carpenters' and joiners' shops in Plymouth Dockyard, where great advantage was derived from their use as regarded savings in the cost of workmanship, no less than in accuracy of the work performed.

Machine tools for workshops need neither be bulky nor costly, nor do they require so much force as when similar work has to be performed by hand. For example, there was a circular saw-frame in Queen-square Place which could not

have exceeded in dimensions a cube of two feet six inches, including the wheel for giving motion to the axis by means of a treadle, and some drawers for tools. The working of it was within the power of an unpractised woman: the saw could be easily adjusted so as to cut at any angle, or to any depth within its semi-diameter of some inches. It was with this very machine tool that Burr worked for several years when making models or machines themselves. It was intended to have been kept, but, by inadvertence, was sent, with other machines, to either Portsmouth or Plymouth Dockyard. The machine for cutting veneers, when in Queen-square Place, was worked by the foot also, and was described by Mr. Mitchell as not occupying more space than a small sideboard. A few machine tools of Bentham's contrivance, though worked by men at Redbridge, produced considerable savings in the works they executed. The mortising and tenoning machine tools, when in Queen-square Place, were all of them worked by the force of man, usually applied either by a treadle or by a winch to turn an axis.

But supposing even that labour were not economized by machine tools, their "invariable accuracy" would alone justify their use in common workshops.

Machinists would do good service by employing their skill in the construction of machine tools on a small scale, giving preference to those suited to the performance of the commonest operations in working wood and metals. The unhealthy labour at a forge might be much diminished by the introduction of small tilt-hammers; riveting might be more certainly effected thus than it can be by hand; rasping, filing, and polishing of both wood and metals, would, for example, be better and more easily done by a machine tool than in the usual mode; and so of many another operation.

Machine tools for the common workshop should be contrived so as for each one to perform the greatest number possible of nearly similar operations, and for different materials. In very many cases the bulk of the apparatus remaining the same, by a simple change of the cutting, abraiding, or polishing tools, a great variety of works might be performed. Such machine tools should further be furnished at a moderate price, such as would suit the purses of master artizans, though they might have but a very moderate share of employment.

Good workmanship of wood, however, whether by machine-tools or otherwise, can be but of little avail, so long as the material is not well seasoned. Take for example, a deal press lately made by a master joiner, esteemed a superior workman; the wood he used, not having been well seasoned, has cracked and split in many places, in some leaving openings of a line or two; besides which, the doors have shrunk much more than to an equal amount. In the same room stands a press of similar nature and material, fully exposed to a mid-day sun; this one was made by a very inferior workman three years ago, but in this instance the wood was perfectly seasoned before making up; this press has to the present time stood without a crack.

If it be desirable to make machine tools for workshops of a small character, it is no less so to furnish them with well-seasoned wood. The petty carpenter cannot keep a stock of it himself, nor can he go to any considerable distance for a supply, perhaps, daily needed. How, then, could he be furnished? By inducing small timber merchants to season their wood before selling it—they could hardly fail to find their account in so doing. The Messrs. Strutt, at Belper, half a century ago, seasoned wood artificially in a chamber of small dimensions, by regulating a current through it of heated air to not more than about 65° Fahrenheit. Their seasoning-chamber might be imitated in any ordinary room by admitting more or less air to it at pleasure, heating it moderately by an Arnott's stove, or any other requiring little attendance, then carrying off moisture, at little cost, by means of a cowl-capped vapour chimney.

In such a chamber some little attention and contrivance would be requisite in directing entering air to the stove, in spreading abroad that air when heated, so that it should not escape till it had done its duty in carrying with it as much water as it would take up.

Special care should be taken not to overheat the chamber, lest cracks in the wood should be the consequence of a too rapid withdrawal of the water it might contain.

M. S. B.

PATENT LAW CASE.

Newall v. *Wilson*.

COURT OF CHANCERY, Saturday, April 17. Before the LORDS JUSTICES of APPEAL.

Mr. SELWYN proceeded with his argument for the defendant (for previous proceedings see current vol., p. 256) and contended that the patent taken out by Mr. Newall was for a thing not new, and further that the representation he made to the Crown, when he petitioned for and obtained the patent, was untrue on his own showing, for in his petition he stated that he had partly obtained his information from a person abroad, and partly by his own discovery, while in his bill he stated, and in his affidavit he swore that he was the original inventor of the article which he calls his own. Beyond this there was the publication of Albert, from which it appeared that the untwisted wire rope was known and generally used as far back as 1835. In proof that the defendant had not done anything he was not justified in doing, the wire rope of untwisted metal was, in the presence of the plaintiff's own scientific witnesses, at King's College, manufactured from the specification given by Albert in his book, and no one of the witnesses for the plaintiff has ventured to say that it is not a piece of genuine untwisted wire rope. The defendant was willing at the Rolls, and now offered, if the Court would permit it, to permit any number of the bystanders in the hall, whether lawyers' clerks or others, to take wires and pass them through the boards described in this book, and manufacture a piece of rope no one individual wire of which should be of twisted material. The plaintiff would not consent to accept such a challenge at the Rolls, and no doubt would refuse now. If, then, it was clear that the manufacture of the rope was fully explained in the book of Albert in 1835, how could it be said that the plaintiff had a right under a patent taken out some years after? The publication of Albert, in the most express terms, said there must be no twist in each individual wire, for that to prevent it the wires must be kept a certain distance apart, and passed through boards so as to prevent them coming into contact, and especially that there must be no twist of any wire on its own axis. In favour of the defendant there was the affidavit of the late Mr. Frank Forster, who said that the defendant had made for him a piece of "hard bright wire," proving incontestably that there could be no twist, for hard wire could not be twisted at all. Then it was stated by the plaintiff that the defendant had manufactured the rope secretly, whereas it was sworn that in 1848 the defendant told a witness who had given evidence for the plaintiff, that he (Mr. Wilson) would manufacture in spite of the patent of Mr. Newall, which was good for nothing, and that he would "put Mr. Newall's pipe out." The learned counsel concluded an elaborate argument about 1 o'clock.

Lord Justice KNIGHT BRUCE.—The first question before us is, whether the letters patent on which the plaintiff grounds his case have been shown to be bad in law. In my opinion they have not. The utmost extent to which the defendant has succeeded in the question he has raised as to the validity of the patent, is to show that doubt may be entertained. I assume, for the sake of the purpose of the argument, that the defendant has made way so far; beyond that, I confess in my opinion, he certainly has not. The patent, or alleged patent, is of long standing; it has been a contract for a long time—long time at least for such a subject—with the public. It has been allowed to exist for many years. The next question is, whether there has been enjoyment of the right under the patent. Beyond all question there has. The plaintiff's exclusive right has been asserted, and in several instances admitted. He has succeeded on the validity of the patent—he has succeeded, at least, once at law in circumstances in which collusion cannot be said to exist. If during all the time the patent has existed enjoyment and possession cannot be denied—whether perfectly exclusive in every sense does not matter—the plaintiff's title is sufficiently supported by his conduct and the conduct of other parties, so as to bring it within the principle enunciated by Lord Eldon in "Hill v. Thompson," a case with which all are acquainted. The case upon the former argument was broken off at a time when an imputation was thrown on the capacity of the defendant to meet the pecuniary demand which might be made upon him. Such questions are always disagreeable, and are often irrelevant; but in a question where, whether a special injunction shall issue against a continued invasion, or alleged invasion of a patent, such a point is of some importance. The means of a defendant to answer damages, where the balance of convenience is in dispute, are not to be disregarded—are not to be considered as of altogether no importance. When security was asked, the offers of security on behalf of the defendant were profuse, and it is in my most distinct remembrance that security without limit was offered. Now, however, it appears

that no security is forthcoming. I do not altogether rely upon that, but it is not to be disregarded. Speaking for myself, I think that the plaintiff giving an undertaking to abide by any order that the Court may make, should the injunction be hereafter dissolved or varied, the injunction must go.

Lord Justice Lord CRANWORTH. — I take entirely the same view as my learned brother. It is always a somewhat delicate and difficult task the Court has to perform of granting or withholding an injunction. It is true, that if an injunction be granted much injury may be done to a defendant by stopping his manufacture; but, on the other hand, the injury to a plaintiff may be irremediable by refusing to grant the injunction. I have always thought that the rule laid down by Lord Eldon in "Hill v. Thompson," is that which should be adopted in such a case—namely, if there has been long-continued enjoyment under a patent, *primâ facie* the patent is to be considered valid, and the Court ought to grant the injunction. Now, I must confess I have rarely seen a case in which there has been more exclusive enjoyment of a patent than there has been here. The patent is dated in 1840. In 1841 it was infringed, and in August a bill was filed against Smith, and he acquiesced. In February, 1844, another bill was filed against Rowland and Webster. There was no injunction then, but an action was directed, which was tried in June, and the plaintiff was successful, and the defendants acquiescing took licenses. In 1850, another bill was filed against Wilkins and Weatherby, and an action was directed, and after it was tried, and the plaintiff was successful, whereupon the injunction was granted. In August another injunction was granted. If that is not such an exclusive enjoyment as the Court requires to have established before granting an injunction, I do not know what is. All the proceedings of the plaintiff have been practically successful, and in one instance he has been actually so. Whenever he has had his patent invaded he has defended it. The defendant says he has a patent dated in 1850, and that it is in conflict with the plaintiff's patent, and asks why the plaintiff has not taken proceedings to recal it. I do not think a man is bound to proceed by *scire facias* against a patent which does not appear to be publicly used. I am of opinion that this injunction ought to be granted, because the plaintiff has shown such a title as is sufficient to call on this Court to interfere.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING APRIL 22, 1852.

RICHARD ARCHIBALD BROOMAN, of the firm of J. C. Robertson and Co., of 166, Fleet-street, London, patent agents. *For certain improvements in the preparation and treatment of fibrous and membranous materials, both in the raw and manufactured state, whereby they are rendered more durable, are contracted or expanded, are cleaned, and are more capable of receiving and retaining colours.* (A communication.) Patent dated October 10, 1851.

Specification.

The nature of the invention consists in the formation of certain salts or compounds within, or in contact with fibrous and membranous materials (both in the raw and manufactured state), or in the decomposition of certain salts or compounds already existent in or combined therewith, whereby they are in either case rendered more durable, or contracted, or expanded, or cleaned, or made more capable of receiving and retaining colours. And the manner in which the said invention is performed is as follows:

Where the material is of a fibrous nature, such as flax, I prepare it for being treated as aforesaid, as well as for manufacturing purposes generally, by means of a crushing and cleaning machine of the description represented in the accompanying engravings. Fig. 1 is an end elevation of a crushing and cleansing machine. *a a* are

Fig. 2.

two fluted feed-rollers between which the flax enters, and is conveyed forward by them to the four-sided toothed roller, brake, or bott hammer *b*. The upper brake *c*, which is fixed to the slide *d*, and

works in the framing *ee* is brought down by the crank *f* and connecting rods *gg*. During the ascent of the upper brake *c*, the catch or pall *h* acts upon a ratchet-wheel of four teeth, on the end of the revolving brake *b*, which, by a small toothed pinion working into an inside spur wheel, gives motion to the fluted rollers *a a*. On the other side of the revolving brake, or bott hammer *b*, is a square of iron, which being pressed upon by a lever actuated by a spring, keeps the revolving brake or bott hammer in a proper position during the descent of the upper brake *c*. *l* is the fly-wheel for equalising the motion. *n* levers. *o* weights for weighting the feed-rollers *a a*. *p* the feeding board, on which the flax is spread preparatory to entering the feed-rollers. The rapid and continuous ascent and descent of the brake *c*, striking upon the flax between it and the brake *b*, breaks up and separates the woody from the fibrous portions of the flax.

Figs. 2 and 3 represent a modification of the machine just described. The operations of this machine commence with placing the flax on the feed-board *h*, and offering it to

Fig. 1.

Fig. 3.

the drawing rollers *a a* (fig. 3). The flax having passed an inch or two through these rollers, is seized by the oscillating fluted rollers *b b*, which are moved up and down in the framing *c*, by the crank *d*, and connecting-rods *e e*. *f* and *g* are two parts of a bott hammer, consisting of a fluted cylinder *f*, and a toothed hammer *g*. *h* is the feed board; *i* the fly-wheel; *kk* the driving riggers or pulleys.

To produce a "contracting," or as it is technically termed "milling" or "felting" effect on the goods operated upon, I so combine certain substances as to form a compound or salt incorporated bodily therein, or intimately combined therewith, taking care that the combination is not preceded by decomposition. For example, I steep the goods in dilute sulphuric acid, and then without any intermediate washing, immerse them in caustic soda, whereby a sulphate of soda is formed, which produces the desired result. Other acids than sulphuric, and other hydrates than soda may be substituted. If I employ oleic, or any other similar organic acid, instead of sulphuric, a compound is formed in the material itself, and the same result obtained.

To produce an expansive effect, or one the opposite to contraction, or milling or felting, I first saturate the material with some compound (say, for example, a carbonate), which on subsequent contact with an acid will suffer decomposition, accompanied by the escape of gas. I sometimes employ instead of an acid, some salt, such as alum, which having an acid reaction, decomposes the first compound, and sets free the gas. Mere heat alone may be made to serve the same purpose as the acid body; and so also cold may be substituted for the alkaline action. Thus, milling or felting may be produced by immersing a heated body suddenly in a cold medium, and expansion effected by reversing the process.

To clean or decolorise a fibrous or membranous substance, I first produce chemical decomposition in the substance itself.

By decomposition, here is meant the separation of the constituents forming a compound body, which separation must always be accompanied by an evolution of gas. Thus, if a substance be immersed in a carbonate, and then exposed to the action of sulphuric acid, carbonic acid in the state of gas is evolved, and a sulphate of the base is formed. Instead, therefore, of following the ordinary chlorine bleaching process, I proceed in the following manner:—Suppose white China silk is the article to be operated upon, I first immerse it in a solution of sulphate of magnesia, then transfer it to a bath of carbonate of potash or soda, upon which an insoluble carbonate of magnesia is formed in the silk; I then dip the silk so impregnated in an acid which will decompose the carbonate and form a soluble salt which is afterwards easily removed by washing.

A good compound for cleansing as well as for milling and felting purposes, is formed by combining some oily, fatty, or resinous compound (hydrocarbons) with an alkaline carbonate or hypochlorite. In this case, a hot solution of carbonate of soda is first prepared, and there is then added to it cold oleine, fat, resin, or other suitable hydrocarbon until the base is saturated. To facilitate the combination of oily, fatty, or resinous compounds with alkalies, I saturate cloth or other porous material, such as pumice-stone, with the oily, fatty, or resinous compounds, and then boil it in an alkaline solution, by which means I obtain a larger surface to act upon.

To preserve animal or vegetable substances, I form a salt or compound of an antiseptic nature within their cells or fibres, taking care that the combination is not preceded by decomposition, or accompanied by the evolution of any gas. Thus, for example, to preserve meat, I immerse it first in muriatic, nitric, or acetic or saccharic acid, or other equivalent compound, and then into a solution of some basic hydrate, which, with the preceding acid or any other equivalent acid or compound, will form in the meat itself an antiseptic salt. The meat thus treated will be perfectly wholesome, and will keep so for a long time.

To preserve and tan hides and skins, I form in like manner within those substances some conservative salt; for example, I steep them in tannic or other similar acid, and then immerse them in a mixture or solution of some hydrate, such as those of soda, lime, magnesia, baryta, or alumina.

As it is important, however, to avoid the formation of tannates of soda or potash, on account of the deep colour communicated by them to the hides, I prefer those bases which, with tannic acid, give the least amount of colour; such, for example, as magnesia.

To preserve wood, canvas, and other like fabrics, I form a salt within the fibres thereof, by first immersing them in some suitable acid; such as sulphuric, pyroligneous, or muriatic, and then in a solution or mixture of some suitable base.

If I wish to produce colour in wood or any other vegetable substance, as well as to preserve it, I use a solution of catechu or some other colouring material, and afterwards a solution of caustic soda or potash, whereby subinate of soda or potash is formed within the fibres of the substance.

To promote the germination of seeds, and cause them to throw out powerful first and second sets of leaves, whereby they may the more rapidly and effectually absorb food from the air, I form some fertilizing or stimulating compound within the seeds themselves in manner following:—I steep the seeds in phosphoric acid, and then in ammonia, potash, or lime, whereby a phosphate of one of those bases is formed within the seeds.

To increase the power of absorbing and retaining colouring matters in animal and vegetable substances, I form mordants or the constituents of the mordants therein, as follows:—If, for example, I wish to use acetate of soda as a mordant, I do not immerse the material in a solution of that salt, but I dip it in acetic acid, and then in caustic soda, without any intermediate washing.

I may mention the employment, as mordants, of certain alkaline combinations with hydrocarbons; such as of turpentine with potash, naphtha with potash, soda, fusel oil with potash, &c.

Or the colouring matters or their constituents may be combined in the fibre, fabric, or membrane itself. Fabrics and membranes may also be printed by similar means. Thus the pattern may be stamped by the acid or alkali, and the whole article then immersed in the solution of the base or acid, the mordant will only act on the spots where the acid is in contact with the cloth or membrane.

I may mention, also, that salts may be formed or decomposed, for the purpose aforesaid, by the action of gaseous bodies on them—as, for example, by exposing hydrate of soda to sulphurous acid, chlorine, or carbonic acid; also by exposing a carbonate in solution to sulphurous acid or chlorine gas.

In all the foregoing processes, and in the examples given, the effects produced are supposed by the inventor to be the result of some peculiar electrical condition communicated to the fibres, fabrics, or membranes by the combination or decomposition of salts in intimate contact therewith. Aware of the enormous development of electricity which accompanies chemical ac-

tion, he believes that, by altering the electrical condition of animal and vegetable substances, a state of polarity is produced, or what is usually denominated a negative or positive result, on which the power of any substance to contract or corrugate (milling and felting), to resist decomposition, or to receive and retain colours, mainly depends. He further considers that electric currents move in two opposite directions, either centrifugal or centripetal, and that many of the phenomena attendant upon the absorption or loss of colour,—as in dyeing and bleaching, or the twisting and corrugation of fibres, as in milling or felting, or the resistance of decay, as in tanning and salting,—depend upon the kind of electricity developed at the time, and that such condition of electricity can be established by the means hereinbefore described. It seems to follow, moreover, from the principles laid down, that by simply reversing some of the processes given as examples, an opposite effect should be produced; and so, in point of fact, it is found that if the process given for preserving meat is reversed, its decay is accelerated.

The principal materials to which thes processes are applicable, are the following: flax, hemp, cotton, jute, manilla-hemp, esparto, aloe, pine-apple-leaf, and generally all vegetable fibres, and yarns or fabrics made therefrom, woods, roots, leaves, seeds and fruits, meat, skins, hides, hair, wool, silk, animal fibre, fish, and all products thereof.

Among the salts most suitable to be employed are the following:—Rubinates; such as rubinates of magnesia, alumina, &c. Tannates; such as tannates of magnesia, lime, ammonia, soda, and potash, &c. Sulphates,—as of magnesia, soda, &c. Salts with an acid reaction, as alum. Carbonates; as those of magnesia, soda, &c. Hydrates; as those of lime, soda, potash, alumina, magnesia, &c. Acetates; as of soda, magnesia, alumina, indigo, &c. Acids of every description may be used: such as acetic, muriatic, sulphuric, nitric, tannic, silicic, &c., and any of the hydrocarbons; such as resins, oils, sugar, starch, &c. The foregoing compounds, however, are merely mentioned as examples, for the inventor does not confine himself to these alone, but claims a right to the use of all known chemical equivalents.

And having now described the nature of the said invention, and in what manner the same is to be performed, I declare that the improvements claimed as embraced by the said invention, are as follows:—

First. The crushing and cleansing machines respectively represented in figure 1, and in figures 2 and 3, and before described; that is to say, in so far as regards the combination of conducting, crushing, and oscillating rollers with a "bott hammer," in the manner herein represented and before described.

Second. The treatment of fibrous and membranous substances, both in the raw and manufactured state, by forming or decomposing salts or compounds within, or combined with the same, whereby they are rendered more durable, or are contracted or expanded, or cleaned, or made more capable of receiving and retaining colours, as before exemplified and described.

Third. The use of tannate and rubinate of magnesia, for the treatment of membranous and fibrous substances; such as hides and skins, wood, &c., as before described.

And, *Fourth.* The employment for cleaning fibrous and membranous substances of a compound of an alkaline carbonate, or hypochlorite, with a fatty or oily, or resinous body, as before described.

William Onions, of Southwark, engineer. *For improvements in the manufacture of nuts* "and bolts; also of steps, bearings, axles, and bushes; also of *mills and dies for engravers; also of* 'bells,' *lathe and other spindles; also of weft forks, shuttle tongues and tips for looms;* also parts of agricultural implements, chains, roller guides, and throstle bars," *by the application of materials not hitherto used for such purposes.* Patent dated October 16, 1851.

A disclaimer has been entered to the title of this patent, by which the words above printed in Roman characters are disclaimed, the parts of the invention comprehended thereunder having been found to be "not useful."

The improvements consist in manufacturing the several articles above mentioned in metal which is capable of being rendered malleable by annealing in the presence of oxide iron ore, or oxide of iron. The metal which the patentee uses is composed of two parts of hæmatite iron ore, four parts of steel of the ordinary make, and ninety-four parts by weight of iron, made from Cumberland or other similar ore. These several matters are melted together, and as it is found desirable to cast the articles to be made direct, instead of running the metal into ingots, and remelting it, the patentee prepares, from accurate metal patterns, sand moulds of the required shape, into which he casts the molten metal. The castings thus obtained are then annealed by placing them in an annealing kiln in boxes, in contact with powdered oxide iron ore, and afterwards dressed and reduced to the exact required sizes and shapes of the several articles to be produced, by any of the

means ordinarily employed for that purpose. The time required for the annealing will vary with the thickness of the articles under operation, as is well understood.

Claim.—The manufacture of nuts, mills and dies for engravers, lathe and other spindles, shuttle tongues and tips for looms from metal of the kind above described, by casting the same into the forms of the several articles, and then annealing the castings in the presence of oxide iron ore, or oxide of iron.

RICHARD DOVER, of New-street, Spring-gardens, merchant. *For improvements in treating sewage, in obtaining products therefrom, and in combining such products with other matters.* Patent dated October 16, 1851.

These improvements consist in deodorizing putrescent sewage by the addition of muriatic or other similar mineral acid, with a salt or salts, or other chemical compounds, and in applying the solid products to the manufacture of manure by combining the same with fertilizing matters.

The acid which the patentee prefers to use is muriatic (otherwise called hydrochloric) acid, which he adds to the sewage water in the proportion of 5½ lbs. to every ton, with chloride of sodium in the proportion of 3 ozs. to the ton, and protosulphate of iron 6 ozs. to the ton. In lieu of using chloride of sodium, other chlorides, as of potassium, magnesium, and calcium, may be employed, and in place of the protosulphate of iron, the sulphate of peroxide of iron and other salts which are capable of having their bases separated or precipitated from the acids with which they are combined by the action of the chemical constituents of sewage may be used. In addition to the above-named salts, there is also added to the sewage under treatment a small portion of protochloride, otherwise called muriate of iron. These several matters having been mixed together, are added to the sewage, and having been combined therewith by mixing, the whole is filtered to obtain the solid portions. These are then mixed with marl or other substances, and applied as manures, or the substances employed as filtering beds, such as charcoal, gypsum, or peat may be mixed with the solid portions for producing fertilising compounds. The solid matters may be treated with chemicals to obtain products therefrom, and the liquids passing through the filters may be similarly treated to obtain the ammoniacal salts contained in them.

THOMAS PERRY, of Tower-street, Leicester, machinist. *For improvements in the manufacture of looped fabrics.* Patent dated October 16, 1851.

These improvements have relation to that part of the process of manufacturing which consists in ornamenting or narrowing the fabric by removing some of the threads from their needles to other needles in the machine; or, at it is termed, "tickling" off the work. The tickling instruments have been hitherto worked principally by hand, but the patentee now makes them capable of being actuated by a perforated barrel or pattern surface, and thus to produce patterns on, or narrow the fabric without rendering it necessary for the workman to manage the tickling points. The points are made capable of independent action to admit of their being worked by the pattern surface employed.

Claim.—The mode described of combining and applying apparatus to be worked by pattern surfaces for tickling off the work in knitting machines.

THOMAS LIGHTFOOT, of Jarrow Paper-mills, South Shields, paper manufacturer. *For improvements in machinery applicable to the manufacture of paper.* Patent dated October 16, 1851.

These improvements have relation to that part of paper-making machinery known as the rag engine. This apparatus, as in general use, consists of an oblong trough divided for about two-thirds of its length by a partition, at the ends of which a clear space is left between them and the ends of the trough. At the bottom of one compartment of the trough are placed a series of vertical knives, called the "plate," and above the plate revolves a roll having knives on its periphery, between which and the plate the rags in the engine are torn, ground, or reduced to pulp. At the back of the plate the floor of the vat rises, and this rise is called the "weir." When in action, the vat is supplied with water, and the revolution of the roll draws the rags placed in it between the plate and the roll and up the "weir," descending from which the rags acquire sufficient momentum to carry them round the partition along the clear compartment of the engine, and again in front of the roll, by which they are acted on until sufficiently ground and reduced to pulp.

The first improvement proposed by Mr. Lightfoot is, to have two rolls instead of one only, the second roll being placed behind the first, and revolving at a higher speed. The rags, after passing between the first roll and plate, are thrown in an opened-out state on the second roll, and by its revolution carried between it and the second plate, and then ascending the "weir," are caused to traverse the free compartment of the engine, and are again seized by the first roll, and are subjected to the tearing operation repeatedly until brought to a pulpy state.

Water is supplied between the rolls by a perforated pipe extending across that compartment of the engine.

In connection with the improved engine, Mr. Lightfoot adopts an entirely new system of washing, which constitutes the second branch of his invention. The "midfeather," as the partition of the trough is technically called, is made hollow, and on that side which bounds the clear compartment is finely perforated in several places, or has openings made, which are closed with finely-perforated plates or wire gauze. The opposite side of the trough is also made hollow, and similarly provided with apertures closed by wire gauze. In the floor of the trough are formed, lengthwise or across, a series of gutters communicating with the hollows of the "midfeather" and side of the trough, and with the bottom of the trough by means of strainers of wire gauze laid over the tops of the gutters. The gutters communicate by two discharge pipes with a cistern, and the discharge pipes are each provided with the slides, to which a reciprocating movement is communicated by a crank or other arrangement from a suitable prime mover. The object of this arrangement is to admit of the dirty water being allowed to escape, and that it may not by its suction carry with it any portion of the fibres of the pulp through the strainers in the bottom of the trough, the water is caused to escape through the exit-pipes alternately and at intervals. With the same view also of decreasing the amount of suction of the escaping water on the pulp, the cistern in connection with the discharge pipes is provided. This cistern has two exit orifices, one at a higher level than the other, the lowest being used at the commencement and the highest towards the terminations of the grinding of a charge of rags.

A third improvement consists of an arrangement of apparatus to be used when washing and boiling rags. The patentee employs a perforated cylinder having teeth projecting inwards, and mounted on a hollow perforated shaft, also provided with projecting teeth. The cylinder revolves in a water-tight vessel, and by its rotation in conjunction with the action of the teeth on the shaft, the rags contained in it are thoroughly cleansed and torn to pieces. A portion of alkali is then introduced into the cylinder, and the rags are boiled by admitting steam through the hollow shaft on which the cylinder is mounted.

Claims.—1. The employment of two rolls in the rag engine, one of which is driven at a speed superior to that of the other.

2. Making the sides and bottom of the vat and midfeather hollow.

3. The method described, or any modification thereof, whereby the dirty water may be carried off from the rags or pulp, and the flow of the dirty water from the engine may be periodically interrupted, so as to prevent the pulp being sucked through the straining surfaces.

ROBERT JAMES MARYON, of York-road, Surrey, gentleman. *For improvements in obtaining and applying motive power, and in signalizing.* Patent dated October 10, 1851.

The improvements here claimed have relation to several methods of working guns, capstans, windlasses, &c., and to an omnibus signal, descriptions of which will appear in an early Number.

MATTHEW GIBSON, of Wellington-terrace, Newcastle-upon-Tyne. *For improvements in machinery for pulverising and preparing land.* Patent dated October 16, 1851.

The improved machinery which forms the subject of this patent, consists of two sets of discs mounted on parallel axes, with the discs of one set working into the spaces between those of the other set. The bearings or levers which carry the axes for the sets of discs are suspended at the centre on axles which also carry wheels when the machine is to be moved from place to place, and by this means the discs are capable of a rocking movement on their axes, which admits of their adjusting themselves to any inequalities of the ground, and will be found to produce also, by keeping the discs always in contact with the ground over which they are being moved, a very efficient pulverising and crushing action. The discs are shown with bevelled edges, but may be otherwise made if thought desirable.

Claim.—The mode of combining parts into a machine for pulverising and preparing land.

JOHN RAMSBOTTOM, of New Mills, Derby, engraver. *For certain improvements in machinery or apparatus for measuring and registering the flow of water and other fluids or vapours, which machinery or apparatus is also applicable to registering the speed of, and distance run by vessels in motion, and for obtaining motive power and other similar purposes.* Patent dated October 22, 1851.

The "machinery or apparatus" above alluded to, consists of an oval-shaped vessel within which is mounted at one side a cylinder or shaft, capable of revolving on its axis, through the centre of which passes a slide or diaphragm, the length of which is so calculated with reference to the internal curve of the oval and the position of the cylinder or shaft, that it shall be capable of being in constant contact at both ends with

the interior of the oval vessel at the same time that it passes exactly through the centre of the cylinder. At the point where the cylinder touches the interior of the oval vessel is attached a stop-plate, and on each side of this plate are formed the passages for the inflow and outflow of the fluid to be measured. The fluid on entering, acts against the slide, and causes through it the shaft or cylinder to rotate, and the rotation of the cylinder is caused to actuate suitable mechanism for indicating the quantity of passing fluid. Or motive power may be obtained by the force of the fluid passing through the apparatus, and the amount of power will be equal to the head of water supplying the apparatus. When steam is the motive agent employed, the patentee adopts the following mode of working:—Considering that a vacuum is created by the passage of the slide past the stop-plate, the patentee causes hot water, the temperature of which is more than 212° Fahr., under pressure, to be projected from a steam boiler into the said vacuum. The absence of pressure here is sufficient to cause the sudden conversion of the water into steam, which is then used for actuating the slide in the apparatus, and producing motive power. To facilitate the conversion of the hot water into steam, in the event of it not possessing sufficient latent heat for the purpose, the patentee introduces into the apparatus simultaneously with the hot water a certain portion of superheated steam.

When the apparatus is used for measuring the distance run by vessels in water, it is constructed with two slides crossing each other at right angles, and is wholly immersed, the inflow pipe being placed so as to meet the current. The water passing through the apparatus, while the vessel is in motion, actuates the slides and shaft, and their motion is caused to work an indicator attached to the apparatus.

Claim.—The use of an oval vessel or cavity, within which is another vessel or shaft, either solid or cylindrical, made proportionately to each other, and through the centre of which cylindrical vessel there moves one or more slides or diaphragms whose sides touch the ends of the oval vessel, and whose ends touch the circumference of the oval vessel, during the revolution of the said slides and cylindrical vessel, and having supply and exit passages for the purpose of measuring and registering the quantity of water and other fluids drawn off; for measuring the distance run by vessels on water, and indicating the rate of their speed or momentum; and for obtaining motive power by means of water, steam or other fluid or vaporous bodies; which apparatus is also applicable to the exhausting, compressing, and ejecting of fluids.

RICHARD ROBERTS, of Manchester, engineer. *For improvements in machinery or apparatus for regulating and measuring the flow of fluids, also for pumping, forcing, agitating, and evaporating fluids, and for obtaining motive power from fluids.* Patent dated October 17, 1851.

Claims.—1. Regulating the flow of fluids by the application of power derived from the fluid to be regulated.

2. The application of curved or spiral divisions to rotary meters, to give a rotary motion to the fluid passing through.

3. Constructing the wheels of rotary meters with straight vanes.

4. Tapering the lower edges of the vanes.

5. Making the outer circumference of the vanes of rotary meters slightly conical, and the casings in which they revolve of a corresponding shape.

6. The application of an oscilating cylinder or chamber to meters for regulating the flow of fluids.

7. A peculiar application of yielding substances to maintain the flow in the exit pipe uniform, or nearly so.

8. The application of self-acting apparatus for allowing air to escape from fluid meters, however constructed.

9. Certain modes of constructing the apertures for the ingress and egress of the fluid to be measured.

10. A peculiar combination and arrangement of parts for pumping.

11. The application of cycloidal or other suitably shaped bosses to machinery or apparatus used in forcing fluids. (The patentee shows these bosses attached to the ends of screw propeller shafts, where two screws are employed one under each quarter of a vessel.)

12. A peculiar combination of machinery or apparatus for agitating or evaporating fluids. (A churn.)

13. Suspending the drums of centrifugal machinery, when used for agitating or evaporating fluids, by means of cords or chains from the vertical shaft.

14. A mode of increasing the draught in chimneys or flues used in combination with machinery or apparatus for evaporating fluids.

15. A mode of producing rarefaction by admitting a current or jet of steam into chimneys or flues used in conjunction with machinery or apparatus for evaporating fluids.

16. A mode of accelerating evaporation by the introduction of tubes into the fluid

to be evaporated, and by connecting the vessels containing the fluid with a chimney or flue.

17. A peculiar combination of machinery or apparatus for obtaining motive power from fluids.

18. The application of the power of a column of water to opening and closing locks, dock-gates, swivel bridges, and other machinery of like nature.

19. The direct application of the pressure of steam or water for compressing and packing goods, hooping barrels and casks, and for other like purposes.

WILLIAM BOGGETT, of St. Martin's-lane, gentleman, and GEORGE HOLWORTHY PALMER, of Wesbourne Park Villas, Paddington, civil engineer. *For improvements in obtaining light and heat.* Patent dated October 22, 1851.

Claims.—1. Several arrangements for heating apartments by the burning of gas, or gas and air in combination with solid luminous and incombustible bodies, such as asbestos, respectively described.

2. The heating of apartments without deterioration of the atmosphere thereof, by the burning of uncarbonized hydrogen gas in open gas fireplaces, as described.

3. The constructing of gas burners for lighting and heating purposes, of certain peculiar forms described, or any of them.

4. The placing and adapting of prismatic lenses, to increase the effect of gas and other lights in a peculiar manner described.

5. Certain improvements in gas cooking apparatuses, and more especially various arrangements therein embodied, whereby the heat is directed in a downward direction upon the substances which are in the course of being cooked or heated.

6. The use for heating purposes of gas burners, having lateral slits or openings between plates of cast iron or other suitable material in place of round holes for the emission of the gas, when there is more than one such slit in the burner or when more than two such burners or parts of such burners are combined together.

7. The combination of absorbents of heat with gas burners in a peculiar manner represented and described.

8. The construction of gas stoves with angular reflectors in a peculiar manner exemplified and described.

9. The combination of open gas fireplaces with woven wire guards as described.

10. The use of gas burners of cast iron having slits cuts therein for the emission of gas as described.

11. The heating of spatulas by gas, and the same method of using gas for heating laundresses irons and other similar irons.

12. An apparatus for warming and conveying air to conservatories, &c.

13. An improved blow-pipe.

14. An apparatus for heating soldering irons.

15. A method of constructing ovens.

16. Several arrangements of apparatus for heating fluids.

17. A gas gridiron.

18. Certain gas stoves, represented and described.

19. The application of gas heat in a downward direction, by means of parallel tubes placed near to each other, and perforated at the bottom or sides, as exemplified and described.

20. The use of soapstone in the construction of stoves, burners, and other gas apparatus.

21. The employment in the application of the carbonic oxide of furnaces to heating purposes of different economical methods or processes specified.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Henri Gustave Delvigne, of Brixton, Surrey, gentleman, for certain improvements in fire-arms, and in the methods of discharging the same; also improvements in projectiles. April 17; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in machinery or apparatus for cutting paper, pasteboard, or other similar substances. (Being a communication.) April 17; six months.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in the method of and apparatus for indicating and regulating the heat and the height and supply of water in steam boilers, which said improvements are applicable to other purposes, such as indicating and regulating the heat of buildings, furnaces, stoves, fireplaces, kilns, and ovens, and indicating the height and regulating the supply of water in other boilers and vessels. April 17; six months.

John Gillett, of Brails, near Shipston-on-Stour, Warwick, agricultural implement-maker, for certain improvements in ploughs. April 17; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the manufacture of lenses. April 17; six months.

William Henry Dupre and Clement Le Sueur, of Jersey, for improvements in certain apparatus or apparatuses for preventing smoky chimneys, applicable to other purposes of ventilation. April 17; six months.

Clemenz Augustus Kurtz, of Manchester, manufacturing chemist, for an improvement in all preparations of every description of madder roots and ground madder, in or from whatever country the same are produced; also of munjeet in the root and stem, from whatever country. April 17; six months.

Henry Stothert, of Bath, engineer, for improvements in the manufacture of manure. (Being a communication.) April 17; six months.

William Hyatt, of Old street-road, Middlesex, engineer, for improvements in obtaining and applying motive power. April 17; six months.

John Knowles, of Little Bolton, Lancaster, cotton spinner, for improvements in certain machinery for preparing cotton and other fibrous substances, for reversing the direction of motion in,

and for regulating the speed of machines. April 17; six months.

John Trotman, of Dursley, Gloucestershire, for improvements in anchors. April 20; six months.

Robert Griffiths, of Clifton, engineer, for apparatus for improving and restoring human hair. April 20; six months.

Robert Reyburn, of Greenoch, chemist, for improvements in printing on silk and other fabrics, and yarns. April 20; six months.

William Maddick, of Manchester, manufacturing chemist, for the production of a liquid extract from madder, and its preparations, suitable for the purposes of dyeing or printing, and a new treatment of spent madder, garancine, or garanceaux, or other preparations of madder, to render them available for the like purposes. April 20; six months.

John Ridgway, of Cauldon-place, Stafford, china manufacturer, for certain improvements in the method or process of ornamenting or decorating articles of glass, china, earthenware, and other ceramic manufactures. April 20; six months.

William Hindman, of Manchester, gentleman, and John Warhurst, of Newton-heath, near Manchester, cotton dealer, for certain improvements in the method of generating or producing steam, and in the machinery or apparatus connected therewith. April 22; six months.

Edward Hammond Bentall, of Heybridge, Essex, ironfounder, and James Howard, of Bedford, ironfounder, for improvements in the mode of chilling cast iron. April 22; six months.

James Stevens, of Birmingham, glass manufacturer, for certain improvements in lamp glasses. April 22; six months.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in the method of manufacturing, and in machinery to be used in the manufacture of wood screws, part of which improvements is applicable to the arranging and feeding of pins and other like articles, and also improvements in assorting screws, pins, and other articles of various sizes. (Being a communication.) April 22; six months.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in the mode of priming fire-arms. (Being a communication.) April 22; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
April 15	3217	George Bower	St. Neots, Hants	Gas cooking-stove.
,,	3218	H. J. and D. Nicoll	Regent-street	Front part of a double-breasted coat.
,,	3219	W. Longdon	Manchester	Safety noseband.
17	3220	R. Mead and Sons	Frome, Somerset	Hat body.
,,	3221	G. Bowden	Little Queen-street	Porte tableau, or artist's sketch and painting safety portfolio.
21	3222	I. Harris and H. Shorthouse	Kingsbury	Turnip cutting-machine.
22	3223	P. Hunter	Edinburgh	Churn.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

April 15	398	Webb and Greenway	Birmingham	Bolt.
17	399	I. S. Cockings	Birmingham	Fastening for gloves, garters, parasols, &c.
,,	400	W. D. Richmond	Birmingham	Temporary binding for periodicals, &c.
,,	401	W. D. Richmond	Birmingham	Corkscrew.
,, ,,	402 403	B. R. Moore and J. Moore	Clerkenwell-close	Antifriction bearings or supports for a revolving lantern, or lights of a light-house.
,,	404	Captain M. C. Maher	Taunton	"Mars" bullet for fire-arms.
19	405	W. Hall and S. Lilly	Birmingham	External and internal screw lock.

CONTENTS OF THIS NUMBER.

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SEARELL'S PATENT SLATE-SAWING MACHINERY.

Fig. 1.

Fig. 2.

SEARELL'S PATENT SLATE-SAWING MACHINERY.

"FESTINIOG.—*New Sawing-machine.*—On the 25th of March, a large and respectable company assembled at the Welsh Slate Company's Quarry, at Rhinbryfdir, near Festiniog, to witness the trial of a Sawing-machine, for cutting slate, slabs, timber, &c., recently invented and patented by the much-respected agent of the Cwmorthyn Slate Quarries, Mr. A. Searell. This machine differs very materially from the common machines now in general use, as it is capable of making eight cuts at one operation, while the other saws only make one; and, instead of the slab travelling as it now does towards the saw, in this case the saw travels over and cuts the slab on one or both sides of the machine at the same time, and in such widths as may be desired within the extent of the machine. The scientific and other gentlemen who attended and witnessed the trial, unanimously agreed that the machine was an ingenious and highly-useful invention, and no doubt would ultimately supersede all other kinds now in common use for similar purposes. Amongst the company present were Messrs. Francis and Son, Penrhyn Quarries, Messrs. W. Williams and Chissel, Welsh Slate Company's Quarries, Messrs. Holland, Casson, Mathew, Greaves, and Pritchard, Mr. Spooner, Mr. David Jones, Festiniog Quarries, Messrs. Hayward, Carter, and E. Williams, Cilgwyfi Quarries, Mr. Dixon, Brynhafodywern Quarries, Messrs. Stevenson and Lawrence, Pantdraining Quarries, Mr. Owen Thomas, Union Foundry, Carnarvon (the maker of the machine), and other gentlemen from the neighbourhood.—*The Merlin.*

We have now the pleasure of laying before our readers the full "Specification" of Mr. Searell's important invention, with engravings of the apparatus referred to.

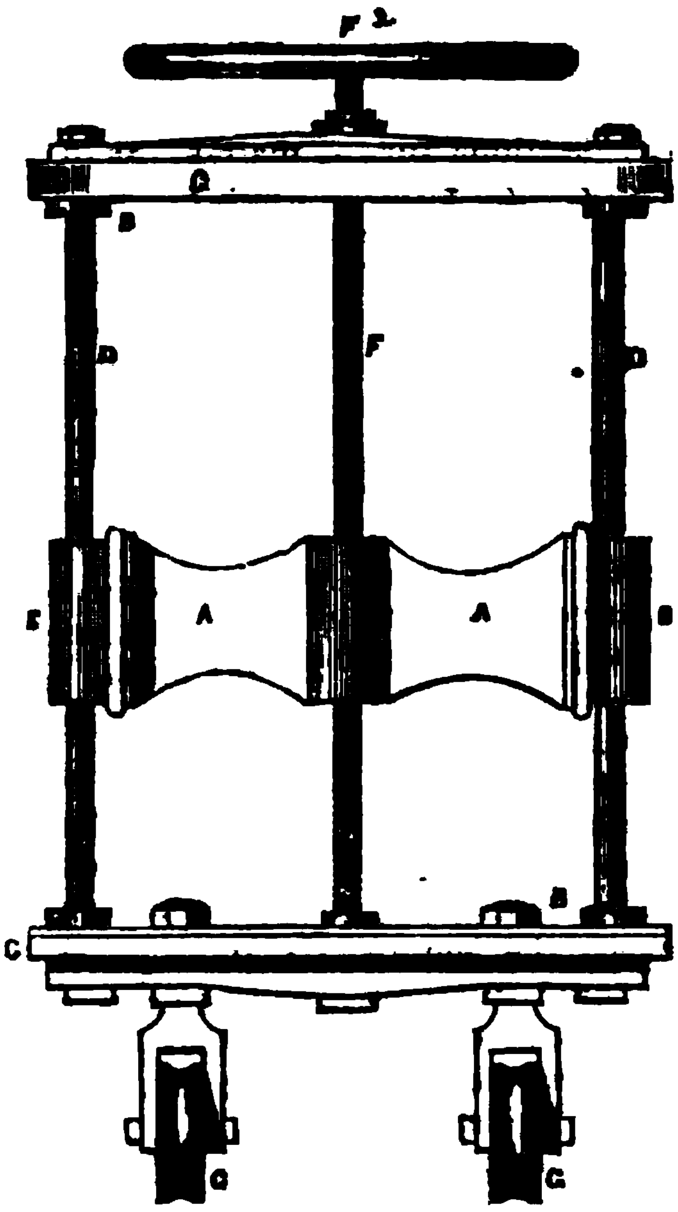
Specification.

My improvements have more especial reference to machinery for cutting up into small pieces such heavy blocks of material as it would be difficult and inconvenient to move forward, or feed against the saw or saws, in the process of cutting, but though my improved machinery will be found more especially useful for this purpose, it may with advantage be applied in most cases where the weight and bulk of the substances operated upon are such as not to exclude the application thereto of the sawing machinery now in use.

In the engravings, I have shown my improvements as adapted to the sawing or cutting blocks of slate. Fig. 1 is a side elevation; fig. 2 a plan; and fig. 3 an end elevation of a machine for this purpose. AA is a long rectangular frame, which is supported at the two ends by upright frames, B B, which last are composed of two cross beams or rails, C C, connected by parallel guide-rods D D, the latter being passed through bosses EE, formed in the ends of the frame A A. FF are screws worked by hand-wheels $F^2 F^2$, whereby the frame A A can be raised further up in the frames BB, or lowered as may be required. The end frames B B are supported by wheels G G, upon which the whole machinery may be moved about from one place to another upon rails suitably placed for the purpose. H H is a saw-carriage, which runs upon wheels H^2 H^2, which rest upon the upper edges of the side rails of the frame A A. $H^3 H^3$ are other wheels which are attached to the saw-carriage H, and bear against the lower edges of the rails; these serve to keep the saw-carriage from shaking, and yet admit of its having a to-and-fro motion on the frame A A. I I are two spindles, which have their bearings in the saw-carriage H, and carry each one, two, or more circular saws $I^2 I^2$, which may either be mounted upon one end or upon both ends of the spindles, as represented in the engravings. $J^3 J^3$ are pinions, which are fixed to the saw-spindles, and gear into a wheel K affixed to an intermediate shaft L. Motion is communicated to the shaft L, and through it to the saw-spindles, by means of an endless band or chain M M, which is passed almost entirely round two pulleys N N (one at each end of the frame A), and also over a pulley O, keyed to the intermediate shaft L. P, P, P, P, are guide pulleys, which bear against the back of the endless band to keep it in close contact with the larger pulleys N and O, and so cause it to take sufficient hold to produce the rotation of the saw-spindles. Or this endless band may be dispensed with altogether, and the saw-spindle may be driven by a bevel cog-wheel fixed thereon, gearing into another on a shaft placed in the centre of the frame A A and throughout its entire length—this second bevel wheel being made to slide on a feather, so as to follow as the saw-carriage H H is drawn forward. The machinery may be put in motion either from a steam engine or other prime source of power, through the medium of a band and pulley R (or by means of a shaft with suitable gearing). If

manual power is employed, it may be applied to the crank-handles S S. The blocks of slate or other substances to be cut are mounted upon carriages, which run upon lines of rail laid parallel to or at right angles with those upon which the machine itself is placed, with a line of rail on each side of the machine, so that the saws on both sides of the machine may be cutting at once. When the blocks are brought into the required cutting positions, the carriages upon which they are placed are securely fixed by blocking the wheels; the longitudinal frame AA is then raised or depressed by means of the screws FF, till the saws are brought to the proper height for producing the intended cut through the blocks; the saws now being put in motion, the travelling saw carriage is made to advance from left to right by means of arrangements such as are next to be described, and thereby the saws are forced to cut their way through the slate. To the front end of the saw-carriage H, there is attached a rope or band, which, after passing over a set of pulleys, is connected to a weight,

Fig. 3.



by the descent of which the saw-carriage is drawn along, and the saws are constantly kept up to their work. Or the slow progression of the saw-carriage may be effected by means of the endless screw T, communicating motion by the set of gear-wheels T^2T^2 to a cross-shaft V, upon which shaft the rope attached to the carriage is wound as the shaft revolves. In general, however, I prefer the method first described of keeping the saws up against the substance to be cut as the requisite pressure is more easily regulated by simply increasing or lessening the weight employed for the purpose. If a cut of considerable depth, say of twelve inches, is required to be made, then instead of making one saw cut the whole depth at once, it is more advantageous to use two saws, the one to follow the other, the first cutting six inches in depth, and the latter one finishing the cut. This machine may be applied to cutting slate, stone, wood or other substance; and, in general, I prefer making the bearings for the several revolving shafts of glass, or of some metal cased in or faced with glass instead of, as usual, making them of brass or other metal.

And having now described my said invention, and in what manner the same is to be performed, I declare that what I claim as of my invention is; *first*, the improved sawing machinery before described, in so far as regards the arrangements whereby the saws are made to advance to their work, while the substances being cut remain stationary.

And, *second*, I claim the forming the bearings of the spindles of sawing machinery of glass, or of some metal cased in or faced with glass. T 2

Royal Slate Quarries, Brynhafodywern, Bangor, April, 1852.

Sir,—Having been one of the parties who lately attended the trial of Mr. Searell's Patent Slate-Sawing Machine, at the Welsh Slate Company's Works in Ffestiniog (see *ante*, p. 342), I was led to reflect that by his having exhibited the invention publicly, much good had been achieved; for it might possibly have taken years of time, by any other method, to have made parties at a distance, and dispersed, so satisfactorily acquainted with the details and working capabilities of a contrivance which is likely to be of so much value to many of them.

From the kind cordiality which pervaded this meeting, I carried my reflections further, and considered that if an *annual meeting* of all parties connected with the working of quarries, and with the manufacture of slate, could be held in Carnarvonshire and Merionethshire alternately, it would enable them to become acquainted with all the plans and inventions of the preceding year, which tended to improve the present mode of working, to economize the conversion of the material, or to turn the latter to the most profitable account. Science, as yet, has been but partially applied to this subject, and the *modus operandi* is nearly where it was fifty years ago. (?) In the two leading slate counties of North Wales there are upwards of ten thousand practical men daily engaged in working on slate; amongst this class instances of great genius are often found, but, unassisted and unencouraged, the ability remains inactive. At the annual meetings which I now suggest, these men, as well as others, should be invited to bring forward their inventions, to exhibit their models and machinery, and also to introduce any new manufacture out of slate, &c.

Papers bearing on the subject *of slate* might also be read at these meetings, and much information would probably be gained relative to its geological formation, &c.; while experience, promulgated on the best modes of working under different circumstances, could not fail of being interesting and valuable to all.

Among the many instances to be brought forward in support of this proposition, it is perhaps sufficient to point to the benefit that has resulted to the cause of agriculture from similar annual meetings for exhibition and encouragement: to these our best modes of culture, our superior breeds of cattle, our improved ploughs, seed-drills, thrashing machines, gorse-engines, &c., all owe their existence.

To carry out this idea, it must be supported by subscriptions to defray expenses and award prizes, and I have no doubt that, when properly organised, and a responsible treasurer has been appointed, the slate quarry proprietors of Wales will liberally countenance a measure which must, ultimately, as a consequence, tend to their benefit.

I venture to subjoin a list of a few of the topics it might be useful to discuss, and it will afford me much pleasure to receive your opinion and suggestions generally on these crude ideas.

I am, Sir, yours, &c.,
E. J. J. DIXON.

FIRST.—*Improvements in general quarrying processes, with regard to cost, and the saving of material.*

Including—Quarry-tools, blasting, pumps, and other quarry appliances.

SECOND.—*Improvements in machinery for the removal of the slate blocks, and rubbish from quarries.*

Including—Railways; wagons—and wheels and axles of ditto; turntables, &c.; inclines and lifts; chains and ropes; and power.

THIRD.—*Improvements in the conversion of slate.*

Including—Sub-division of blocks, splitting, dressing, &c.

FOURTH.—*Improvements in machinery for the manufacture of slate slabs, and of articles from slate material.*

Including—Sawing, planing, moulding &c.

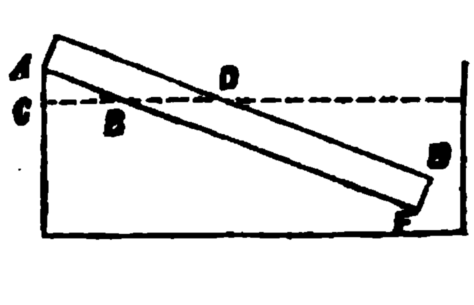
FIFTH.—*New and useful articles manufactured from slate, and for new applications of slate generally.*

THE EXCISEMAN'S STAFF QUESTION.—SOLUTION BY MR. SEPTIMUS TEBAY, OF PRESTON.

Problem.

A given cylindrical staff is immersed at one end in a vessel containing a given fluid, the other end resting on the edge of the vessel. To determine the position of the staff and the conditions of equilibrium, when it is just sustained by friction and the buoyancy of the fluid.

Let AE be a vertical section of the staff, CBD the surface of the fluid. Let



$EF=2a$, $DE=b$, $AF=l$, the length of the staff, $AC=K$, m the part of the axis out of the fluid, y any variable distance estimated along the axis from the lower end of the staff, ϕ the angle which any radius makes with the vertical plane, $\angle ABC=\beta$, μ the coefficient of friction, and D the density of the fluid.

Then the depth of any point in the horizontal chord $2a \sin.\phi$ of the immersed end $=$

$$2a \cos.\beta \sin.^2\frac{\phi}{2} + b \sin.\beta.$$

Therefore the pressure on this point $=$

$$D\left\{2a\cos.\beta\sin.^2\frac{\phi}{2} + b\sin.\beta\right\};$$

and the moment of this force about it $=$

$$AD\left\{a\cos.\beta\sin.^2\phi + 2b\sin.\beta\sin.^2\frac{\phi}{2}\right\}.$$

Now the differential of the area of the end of the staff being $a^2\sin.^2\phi\, d\phi$, the whole effect of the fluid on the end $=$

$$a^2D\int_{-\pi}^{+\pi}\sin.^2\phi\, d\phi\left\{a\cos.\beta\sin.^2\phi+2b\sin.\beta\sin.^2\frac{\phi}{2}\right\}=$$

$$a^2\pi\sin.\beta\left\{l-m-\frac{a}{4}\cos.\beta\right\}D\ldots\ldots(1).$$

Again: the depth of any point in the immersed curve surface is $=$

$$\text{Sin.}\,\beta\left\{2a\cos.\beta\sin.^2\frac{\phi}{2}+b-x\right\}=\sin.\beta\,(u-x)\text{ suppose};$$

and the pressure on this point $=$

$$D\sin.\beta\,(u-\gamma).$$

Hence resolving this parallel to EF, and taking the moment about it as before, we shall find

$$-Da\sin.\beta\int_{-\pi}^{+\pi}\int_{(x=o)}^{(x=u)}d\phi\, dx\,(u-\gamma)\,(l-\gamma)=$$

$$-\frac{Da}{2}\sin.\beta\int_{-\pi}^{+\pi}u^2\left(l-\frac{u}{3}\right)\cos.\phi\, d\phi=$$

$$-\frac{Da}{2}\sin.\beta\int_{-\pi}^{+\pi}\cos.\phi\, d\phi\left\{l-\frac{2}{3}a\cos.\beta\sin.^2\frac{\phi}{2}-\frac{b}{3}\right\}$$

$$\left\{2a\cos.\beta\sin.^2\frac{\phi}{2}+b\right\}^2=$$

$$a^2l\pi\cos.\beta\,(l-m)\,D-\frac{a^2\pi}{2}\cos.\beta\left\{\frac{a^2}{4}\cos.^2\beta+(l-m)^2\right\}D\ldots.(2).$$

Now, let W be the weight of this staff; then by the statical condition of the problem we shall have

$$(1)+(2)=\frac{l}{2}\cos.\beta\,W;$$

which gives

$$W=\frac{a^2\pi}{l}\left\{(l-m)(l+m+2a\tan.\beta)-\frac{a^2}{2}\left(\tfrac{1}{4}\cos.^2\beta+1\right)\right\}D\ldots.(3).$$

Again; the buoyancy of the fluid in the direction of the staff's length is

$$a^2D\int_{-\pi}^{+\pi}d\phi\sin^2\phi\left\{2a\cos.\beta\sin^2\frac{\phi}{2}+b\sin.\beta\right\}=$$

$$a^2\pi\sin\beta\,(l-m)\,D\ldots\ldots\ldots\ldots\ldots\ldots(4).$$

Let P be the pressure on the edge of the vessel. When

$$P-D\,a\sin\beta\int_{-\pi}^{+\pi}\int_{(\gamma=0}^{(\gamma=u} d\phi\, du \cos.\phi\,(u-\gamma)=W\cos.\beta.$$

Taking the integrals between the prescribed limits, we find

$$P=\Big\{W-a^2\pi\,(l-m\,D)\Big\}\cos.\beta\ldots\ldots\ldots\ldots\ldots(5).$$

Now when the staff is just on the point of slipping, the friction ($P\mu$) between the staff and the edge of the vessel, together with the direct buoyancy in (4), must be equal to the weight of the staff resolved in the direction of its length; that is,

$$\Big\{W-a^2\pi\,(l-m)\,D\Big\}\mu\cos.\beta+a^2\pi\sin.\beta\,(l-m)\,D=W\sin.\beta,$$

$$\text{or}\Big\{W-a^2\pi\,(l-m)\,D\Big\}\,(\mu\cos.\beta-1)=0.$$

$$\therefore\ \mu\cos\beta-1=0,\text{ or }\tan\beta=\mu\ldots\ldots\ldots(6).$$

Having thus determined the position of the staff, m may be found from (3) by the solution of the quadratic; and then the depth of the fluid from the edge of the vessel will be given by the equation

$$m\sin.\beta-a\cos.\beta=K\ldots\ldots\ldots(7).$$

Scholium.—A general solution to the noted question on the "*Exciseman's Staff*" may be deduced from equations (3, 7). This question was originally proposed by Mr. John Fletcher, of Oldham, in the *Gentleman's Diary* for 1789, as follows:

"Seeing an exciseman's staff, in the form of a cylinder, three-quarters of an inch in diameter, and 36 inches long, immersed in a vessel of beer at one end, the other end resting on the edge of the vessel, three inches above the surface, I observed 13 inches along the axis of the staff to be dry. Required the weight of the staff, a cubic inch of the beer weighing ·5949 ounces."

In this case we have

$$l=36,\ m=13,\ K=3,\ a=\frac{3}{8},\ D=\cdot5949$$

$$\therefore\ \sin.\beta=,25863390,\ \cos.\beta=,96597541,$$
$$\tan.\beta=,26774377,\ \cot.\beta=3\cdot73530469,$$
$$W=8\cdot2573305.$$

April 23, 1852.

[*Note.*—Having had occasion to refer to the "*Exciseman's Staff*" Question in my notices of the English mathematical periodicals, I communicated it some time ago, at his request, for the consideration of my excellent friend Mr. Tebay, of Preston. The result of his examination of this "vexed question" of the last century has been the elegant generalization just given, which will, no doubt, be most acceptable to a portion of the readers of the *Mechanics' Magazine*. The results in the *Diary* are well known to be erroneous, and led to the reconsideration of the question in the *Mathematical Companion* and in *Leybourn's Repository;* the results being as follows:—*Diary*, 1790, Mr. Taylor finds W = 5·629 ozs.; Messrs. Mason and Youle, W = 6·334 ozs.; Mr. Dalton, W = 6·045 ozs. *Mathematical Companion*, 1800, Mr. Edwards, W = 8·21558 ozs.; Mr. Wolfenden, W = 7·89, or *nearly*, owing to few decimals being used in the calculation; Mr. Bulman, W = 8·214 ozs.; Mr. Edwards, second solution, W = 8·2055. *Mathematical Repository*, Old Series, vol. 3, p. 161, Mr. Farey, W = 8·227719 ozs.; New Series, vol. 1, part 2, page 26, Mr. Rube, W = 8·228 ozs. Most of these agree very nearly with Mr. Tebay's results given above, and the general accuracy of their processes is hence confirmed. It gives me much pleasure to be enabled to lay before the readers of this Journal the very able investigation by Mr. Tebay. — T. T. Wilkinson.]

The signal stations of Boston consist of cast-iron boxes of great strength fastened to the outside of buildings, and connecting with the wires above by means of insulated conductors, enclosed in an iron gas-pipe. Each of these boxes contains a signal key for police communication, and also for some uses of the Fire Department—an electro-magnet included in the circuit, and having an armature carrying a hammer, which raps against the side of the box, as a means of return communication by sound from the central station,—a discharger of atmospheric electricity, which has already been mentioned, and a signal crank, by which the existence and location of a fire is made known to the centre. The signal crank carries a circuit wheel, either on its axis or at a slower rate by means of gearing, which wheel has the proper number of teeth or cams on its periphery to lift a spring and break the circuit in such a manner as to signalize the number of the fire district, and also the number of the station, to the centre, at each revolution. The number of the fire district is given in dots, that of the number of the station by a combination always of dots and lines. Thus the record produced at the central station, by each rotation of the crank in the box, marked district No. 3, station No. 4, might be as follows:

. . .   . — .

The name of the person keeping the key of each signal box is marked upon the door. In case of fire the box is opened, and the crank turned half a dozen or a dozen times. The locality of the signal boxes is carefully chosen, usually opposite to a gas lamp. The central station in Boston is the City Building, from a bracket on the roof of which the wires radiate in all directions. Here the receiving instruments connected with the signal circuits, the transmitting instruments connected with the alarm bell circuits, the testing instruments, and the batteries for the whole system, are placed. An operator or watchman, the only one required for controlling the whole system, is also stationed here.

The instruments receiving the communications, either of fire or police, from the signal boxes, consist; first, of three receiving magnets mounted on the same stand, and connected, one with each of the three signal circuits; and, second, of a triple office alarm or call and a Morse register, with three electro-magnets, levers, and pen points, marking side by side on the same strip of paper, which alarm and register are operated by the receiving magnets and a local circuit. The office alarm consists of three powerful electro-magnets, each striking a blow by means of a hammer connected with the armature on a bell of a tone different from the others. A separate alarm and record is thus obtained for each signal circuit.

The signal of a fire having thus been received at the central station, the operator turns at once to the transmitting apparatus connected with the alarm bells, which consists of the district key-board. This instrument, in its simple form, is a circuit cylinder, carried by clockwork, with keys marked with the district numbers, which bear upon the cylinder when depressed, and complete the circuit at intervals, so as to produce the district signal on the bells with proper pauses, so long as the key is held down. The district key-board may also be constructed in a way similar to the striking motion of a common clock, so as to complete the circuit the requisite number of times when the key of each district is depressed by the action of a gathering pallet. This gives less numerous surfaces of electrical contact, and is therefore preferable, and has been adapted to the system at Boston by Mr. Farmer. It has seven keys for the fire districts, one key for continued blows at two seconds' interval, or fast ringing at the commencement of an alarm, and one key which gives the signal *one*, *one-two* for "all out," which is always to be struck upon the bells when a fire is extinguished, to allow the engines which have not reached the fire to return home. There are also two spare keys not yet appropriated.

For the sake of economy in battery power, the current is thrown on to the three alarm circuits, separately, but in rapid succession, by the arrangement of the key-board. The effect of this upon the synchronism of the bells is inappreciable, when compared with the effect of distance upon the sound of different bells.

An alarm-bell register is connected with the district key-board, having a dial for each alarm circuit. This is so constructed, by means of an electro-magnet armature and ratchets, that a hand on each dial is carried forward one-thousandth of a revolution each time that the battery current is sent out to the alarm bells. It is consequently known in the office how far the various striking machines have run down, and if it is necessary to wind them in anticipation of their usual weekly time.

The testing apparatus consists either of a common clock or an electro-magnetic clock, so arranged as to send the current of a testing battery over all the circuits once an hour, or more frequently. Each circuit

communicates with an electro-magnet having an armature carrying a hammer, and striking a bell when the circuit is completed. At the City Building, in Boston, an electro-magnetic clock thus tests the continuity of all the circuits by a chime of six bells of different note, at the regular striking time of the clock. The battery employed is purposely so feeble that it will not set off the striking machines in the alarm belfries.

The keys upon which the clock operates as above, are attached to a single board, and are also finger-keys, by which the circuits may be tested at any intermediate time. The three testing keys of the signal circuits have also the important function of police communication. By means of these, communication can be held backwards and forwards between the central station and the forty signal boxes. The signal battery connected with the closed signal circuits, at the central station, is about twelve Grove cups. The battery connected with the alarm circuits, and sufficing to liberate the hammers of all the bells, is about thirty-five Grove cups, though a smaller number may easily be used. This battery, in the south circuit of three and a half miles, liberates nine bell-hammers at the same instant.

There are nineteen alarm bells included in the three alarm circuits, which are called into action at will by means of the electric current. In the belfry of each of these is a powerful striking machine, which will now be described. This resembles the striking movement of clocks, made, however, to strike only one blow, and having, as its chief peculiarity, the very beautiful secondary electro-magnetic apparatus for the liberation of the detent, contrived in 1848, by Mr. M. G. Farmer, and for which, or its equivalent, in a weight or spring, he has applied for a patent in its application to machinery. The figure represents the precise form of instrument as well constructed by Howard and Davis for the city of Boston. For striking the large church bells they are at present carried by weights of about twelve hundred pounds, and raise a hammer of 45 lbs. on a handle four or five feet long. The hammers strike through an arc of from two to three feet, with a force equivalent to 800 lbs. falling one inch.

The frame is a most substantial casting. The electro-magnet will readily be recognised, with its armature attached to an upright lever at c. The legs of the electro-magnet consists of half-inch soft iron, surrounded with coils of insulated copper wire,

No. 23, which are three inches long and two inches in diameter. *a* is a falling arm, weighted at the top, which is supported in an upright position by a horizontal lever, resting on the top of the armature lever at *b*. When the armature is attracted to the magnet, the weighted arm *a* falls over until stopped by the adjustable rest in front of it. In falling, a little lever, seen attached to the same axis, raises the latch-shaped detent *d* by means of the pin connected with it. The arm carrying the pin *e*, attached to the same axis with the cam *g*, and connected with the train of wheels of the striking machinery, is thus liberated, and commences to revolve on its axis. In so doing, the cam *g* swings forward the bar *f*, attached to the axis of the falling arm *a*, which is thus raised to its original position; the horizontal lever catches again at *b* if the armature has been released, the detent *d* falls, and the pin *e* is arrested at the end of one revolution. This occupies two seconds, and in the meantime the weight of perhaps 2,000 lbs. has fallen an inch, and a single blow has been struck by the hammer. If the armature were not released from the attraction of the electro-magnet, the horizontal lever would not catch at *b*, and the machine would continue to strike until the circuit influencing the electro-magnet was interrupted. This indefinite and undesirable mode of striking would be produced by holding down the alarm key at the central office. To obtain single blows, for the purpose of definite alarm, the circuit must be completed momentarily at suitable intervals, which is best effected by means of the district key-board. The fly-wheel of the clock-work is shown at *h*. The hammer represented in the figure is usually placed in a belfry above, connected with the hammer lever by a wire.

As part of the bells in the Boston system are also rung for other purposes, an automatic shut-off or switch is connected with the bell-frames, so that the battery current is diverted from the coils of the striking machine when the bell is in motion, and strikes a little electro-magnetic call to inform the sexton that there is an alarm of fire, to which he should give precedence by ceasing to ring.

An apparatus has been described by Messrs. Channing and Farmer for furnishing a constant supply of condensed air by means of the water under pressure in the pipes in cities, which may be applied either to carry a bell-hammer, by means of an air-engine, or, still better, to operate an air-whistle by means of the telegraphic circuit. The water metre of Huse, or other water engines may also be used to lift the bell-hammers. The advantage of such an application is the constancy of the power without the necessity of winding up and consequent limit of force and number of blows.

The experiments recently made in Boston show that the signals are instantly received at the central station from the most distant signal boxes, and that a reply is at once given on the bells with precision and certainty. The striking machinery is not yet adjusted so as to develope the whole amount of sound which can be obtained from the largest bells. As alarms are given by tolling hammers in New York and other cities, no difficulty will be found in bringing out any required amount of sound, in accordance with simple mechanical laws. The telegraphic and electro-motive part of the system, which is the novel part, is perfect and unerring in its action. It is worthy of notice that the circuits in Boston have not been interrupted by any casualty during this winter of unprecedented severity since they were first completed in December.

To show the operation of the system, let us now trace the alarm of fire which, in describing the signal box, we supposed proceeded from district No. 3, station 4. The operator at the central station, on receiving the signal, immediately passes over to the district key-board, and holds down the key for fast ringing. All the nineteen bells immediately begin to strike two-second blows. After a minute or two the operator raises his finger, and then depresses the key marked 3. The bells now strike the district signals of three blows at intervals of two seconds, and then pause six or eight seconds and repeat, as long as the key is held down. Very soon a hurried signal is received over one of the signal circuits. This comes from the random rapping of an engineer on the key in one of the signal-boxes, and is understood by the operator as an inquiry for the number of the station from which the alarm proceeded. This the operator immediately communicates by counting four raps by means of his testing key on the electro-magnet in the signal box, from which the inquiry came. The engineer now knows the locality of the fire within fifty rods, and heads the engines directly to the spot.

Meanwhile the fire is perhaps easily extinguished. The engineer in command sends to the nearest signal-box, and taps *one*, *one-two—one*, *one two*, on the key. The operator at the centre receives the communication, and forthwith depresses the corresponding key of the key-board. The nineteen bells at once strike the signal a few times, and the engines in all parts of the city turn back.

By a multiplication of signal stations, and a suitable provision of bells, the telegraph-

alarm system becomes instantaneous, universal, and definite in its operation. The experience gained in the construction in Boston, will make the application in other cities and towns comparatively easy. In cities like New York, where there are a few large alarm bells, the telegraphic machinery can be applied with great advantage, so as to strike a blow of any required force, and to bring the bells into operation separately or together, so as to limit or extend the alarm. Only one person is required at the centre to wield the whole of such a system, which provides also for a vital organization of the police body throughout the whole municipality.

The expense of the system, completed in Boston, may be estimated at 15,000 dollars. For small towns a similar organisation might be effected for 1,500 or 2,000 dollars, and for the largest city, as New York, the work might be constructed in the most perfect and elaborate manner, bringing every building, as in Boston, within fifty rods of a signal-box, for about 50,000 dollars.

The government of the city of Boston deserve credit for the liberality with which they have thus brought a new application of science to the test of construction. Great credit is also due to Mr. Farmer, the superintendent of construction, in addition to his original contributions, for the practical direction by which the parts of so extensive a system have been brought into harmonious action.

The purpose of a Fire and Police Telegraph is to connect the various parts of a municipality by an intelligent and co-operative law. To accomplish this it has been found necessary to adopt for the municipal body the precise arrangement which is found in the nervous system of the individual.

Thus, in the fire telegraph now approaching its completion in Boston, there is a central station, which is the "brain," the common reservoir of nervous or electric force for the whole system, at which all the batteries are placed, and which is presided over by an intelligent will (the watchman or operator of the central station). From this centre radiate two classes of electric conductors or nerves (the iron wires carried over the houses). The first of these, the "signal circuit," conveys impressions to the centre, is "afferent," "sensitive," to adapt the language of anatomy. The second of these the "alarm circuit," conveys impulses from the centre, is "efferent," "motor." When any disturbance or alarm occurs at the circumference or other part of the system, it is signalized from the "signal boxes," which are scattered throughout the city, and which are the "sensitive extremities" of the sensitive conductors, to the central station, from which, after an act of intelligence and volition by the operator, an impulse to appropriate or corresponding action is sent over the "motor" nerves or conductors to the various belfries, where the electric or nervous agent animates iron limbs by means of the contraction of electro-magnetic muscles, thereby releasing powerful machinery to strike a single blow with each of the tolling hammers. By a combination of such blows, by the intelligent act of the presiding will at the central station, distinct signals, or any others, may easily be struck.

This presents at once an outline of the municipal fire telegraph. The analogy with the living system has been thus wittily stated by the editor of the *Boston Commonwealth*: "Suppose a live coal drops on your toe; the nerves of sensation give an instant signal to the brain,—that is, a feeling of pain. The brain then, by an act of will, conveyed to the muscles along the leg by the motor or alarm nerves, rouses the said muscles to their duty in the case, and the result is, that the coal is kicked off. The municipal fire-alarm arrangement is conducted on this very plan." The perfection of this analogy is a guarantee, in addition to the various ends of security and intelligent action which are thus obtained, that the arrangement is in conformity with a natural law.

A chief peculiarity of the fire telegraph, as a mechanical system, will be seen at once from the sketch above given. It developes the motor functions of the electric circuit, at a distance. Hitherto the telegraph has been chiefly used to convey intelligence, which is its sensitive function. Its application to the development and control of power at a distance, either by its own electro-magnetic energy, or by bringing into action other machinery, which is its muscular or motor function, is to give a wide extension hereafter to the uses of the agent—electricity. In the fire system, both of these vital functions of the telegraph, so to speak, are employed, and also related to each other in their natural order. In proportion as civilization advances, the telegraph is thus to constitute the nervous system of organized social life, relating all the parts and making possible a more perfect co-operation than could otherwise be obtained.

The municipal electric telegraph, applied to purposes of fire and police, was first described in its general principles by Dr. Wm. F. Channing, in 1845. In 1848 its adoption was recommended by Mr. Josiah Quincy, Jun., the Mayor of Boston, and some experiments were made. In 1851, an elaborate plan was finally presented by Dr. Channing to the government of that city,

which was adopted, and is the basis of the system which has been constructed and successfully tested, though not as yet publicly introduced in Boston. The present mechanism and arrangement of the system have been elaborated by Dr. Channing and Mr. Moses G. Farmer, the able Superintendent of Construction.

We shall now proceed to describe the system in its various parts, and with its essential safeguards. The conditions by which permanent electric conductors may be established in a city, is the subject of first importance for all applications of the municipal telegraphs. This may be effected by the following means:—1st. By employing large wires (No. 8) of the best quality of Swedish iron. 2nd. By attaching them to the brickwork of buildings in the most substantial manner by means of wrought-iron brackets holding the insulators 3rd. By selecting public buildings, or lofty isolated buildings, as points of attachment. 4th. By using as long stretches as is consistent with entire safety, say from 200 to 400 feet. 5th. By using duplicate wires, following different routes, between each and every station, (in exposed situations every triplicate wire may be employed). 6th. By avoiding the use of the ground as any part of the circuit. It is well known that the telegraph wires in our cities are very permanent. With proper guardianship, and means of testing a system of duplicate wires, constructed with the above precautions, cannot be interrupted under ordinary circumstances by chance or design.

The insulator used in the Boston system is Batchelder's patent, which is here represented.

The cast-iron cap is represented by the black line in the section. This is lined throughout with glass by the operation of blowing, or with porcelain. The shank is then introduced with a hot mass of glass, or any fused or semi-fused material, by which it is firmly fixed in its place. This is represented by the shaded portion. Between the lower edge of the cap and shank, in the section, there are four inches of glass surface. The re-entering angle of the lower part of the cap protects the glass within from missiles, and is calculated, in a storm of wind and rain, to drive the latter downward, and thus preserve the insulation. The wires pass over the top of the insulator. The shank, which should be longer than is represented, screws into a bracket or the ridge-pole of a house.

Instead of wires insulated above the buildings, they may be buried in tubes under the streets of cities, though at a great increase of expense. In Boston the wires erected (about fifty miles in length) have cost less than 100 dollars per mile, though a plan of erection, which would cost 150 dollars per mile, is recommended by Mr. Farmer for future constructions. The mode of erecting wires, which has been described, applies to all the forms and uses of the municipal telegraph, amongst others to that of furnishing uniform time to a city.

At every station (sixty in number in Boston) dischargers for atmospheric electricity are provided, by presenting points, connected with the ground, in close proximity to the conducting wires.

The circuits of the fire system are divided as already stated, into those of "signal" and "alarm,"—the one conveying intelligence *to* the central station, the other conveying the impulse to mechanical action *from* the central stations to the hammers of the alarm bells. In the signal circuit the battery may be either constantly on or off, the signal being made in one case by breaking, in the other by completing the circuit. Unless the wires, are erected with very great care, the "closed circuit" arrangement is decidedly preferable. In this case, the duplicate wires, between each of the signal boxes on stations, diverge so as to resemble, in the whole circuit, the links of a chain. The signal here is made by breaking the circuit at any one of the signal boxes. Where the open circuit is used, the positive and negative wire is brought to each signal box, and the signal is made by a cross connection between them. The principle of duplicate conductors is preserved by letting each positive and negative wire form an entire circuit, and return to the pole of the battery from which it started. Each signal station is, therefore, connected with the battery at the central station, by wires following two different routes.

The alarm-bell circuit is arranged like the

open signal circuit, and the power of the battery is only thrown upon it when the bells are to be struck.

In large cities great economy and security is obtained by increasing the number of circuits of each kind. Thus, in Boston, there are three signal and three alarm circuits to different parts of the city, which come in separately to the central station, and which may be kept and used entirely distinct.

In case of fire, the operation of the system begins at the signal box or station. Of these there are forty in Boston, distributed at distances of one hundred rods apart. They are so constructed that police communications may be had backwards and forwards between each of these stations, and the centre, in addition to their function of signalising an alarm of fire. By a similar coincidence, a fire and police telegraph has been constructed in Berlin, Prussia, at the same time with that in Boston: this resembles simply the signal circuit and apparatus of the Boston system, but has not the novel and remarkable feature of the latter—the motor or alarm circuit, by which the bells are struck. In Berlin the public alarm continues to be given in the ancient mode, by blowing horns. It is stated that in Berlin there are forty-six signal stations for the private communications of the police and fire department, connected with the centre.

ORIGIN OF EXPANDING SHOT.

In the year 1818, Captain Norton was presented with one of the native tubes* at Bangalore, in South India, and being struck with the peculiar form of the arrows, and finding with what force and accuracy they flew, even to the distance of seventy yards on a calm day, by the force of the breath alone, he was satisfied, after a number of trials, that it arose from the expanding of the thin bore of the arrow filling the tube by the force of the breath. Following up this conviction, on returning to England in 1823, he proposed to the Select Committee at Woolwich a short arrow, four inches long, on that principle, the hollow part being made of sheet iron, and containing its own charge, and having on its point a percussion cap. General Millar, a member, and considered one of the most scientific of artillery officers, observed that such a projectile would be inconvenient to carry; but that if Captain Norton could contrive a shot or shell that would strike *point foremost*, it would be a contrivance of the greatest value. The following year, Captain Norton completed his elongated rifle-shot and shell at Enniskillen, and in 1826 successfully tested them in Dublin, Woolwich, Addiscombe, and Sandhurst, and on more than a hundred occasions afterwards. On Saturday, the 17th March last, at the Pigeon-House, Dr. Gilborn, Royal Artillery, fired one of the rifle-shells into a deal target an inch and a half thick, at the distance of one thousand yards; the shells struck within sixteen inches of the centre, exploded in passing through, and the shot were picked up on the sand. The shell was of the acorn shape, hollow at its base, about the eighth of an inch deeper than half a circle, and the edge of the hollow about the tenth of an inch thick: after being fired, the hollow was deeper and wider (which shape was caused by the force of the explosion) and uniform; within the eighth of an inch of the base of both shot and shell, is a circular groove to tie on a greased patch; the tie is forced off by pushing the shot or shell into the rifle: the weight of each is nearly two ounces; both are cast in the same mould. The shot, of which thirty were fired, are similar to the shell, *minus* the percussion appliance, which is a tube of thin sheet iron tinned, three-eighths of an inch long, and charged with powder, and having a percussion cap No. 26 at each end: the burr at the edge of the caps is bevelled off, to allow them to press freely home on striking the object, and not to press into the sides of the chamber; it fits closely, and about half the upper cap projects in front of the shell. A hollow-headed ramrod must be used; the charge of powder was two drachms and a quarter, sporting powder; the rifle barrel two feet nine inches long; and the turn of the rifles once in four feet. The four grooves were shallow, like the Minié; the shell, and almost all the shot, were picked up on the sand, and had the impression on

* "*Expanding Projectiles.*—The Malays, Chinese, and natives of South India use an arrow with a hollow piece of the pith of the lotus in the form of an extinguisher attached to one end in the place of feathers. In blowing this tiny arrow through a long tube, the finely turned pith expands, and fills the bore of the tube, preventing loss of power by windage. If they did not find by long experience that this was the result, they would not be at the pains of so nicely turning the pith in that form; an operation which our best turners would find very difficult, it being so like the pith of elder."

them as fully as if they had iron caps in them; the iron cap will sometimes turn on one side, more or less; but the force of the explosion in Captain Norton's shot and shell makes always an *uniform* hollow. Mr. Donahue, of Fitzwilliam-street, shot from the shoulder, and put several shots into the target, and one within four inches of the centre.

The sword of the Moslem and the Saracen's glaive have done their work; the broad arrow of England has done its work, and it remains to be seen what the British elongated rifle-shot and shell, deduced from the Malay tiny tube-arrow, may effect in the future destinies of the world.

N.

TRIAL OF FIRE ENGINES.

On Saturday last, April 24th, a number of engineers and scientific gentlemen assembled, by invitation of Mr. Nye, at his wharf, near the Surrey Canal-bridge, Old Kent-road, to witness a "practical trial exhibition" of Mr. Nye's invention, by which he states he has "obtained an immense increase of speed and power in machinery, without increasing the power of the prime mover!" It is needless to say that many of the gentlemen who honoured Mr. Nye with their company were exceedingly sceptical as to the fact of his having accomplished so astounding a feat, while others,—some of whom were evidently thorough-going perpetual-motion seeker,—placed implicit confidence in Mr. Nye's vaunted capabilities. The first experiment was the trial of Mr. Nye's patent fire-engine, "to test its merits against the best fire-engine now in use—the West of England." Mr. Nye had previously applied to Mr. Braidwood, the Superintendent of the London Fire Establishment, for a trial with one of their engines; but, as Mr. Nye's engine was rather more than double the capacity of the Brigade engines, Mr. Braidwood required to use *two* of his engines coupled, to which Mr. Nye demurred, and applied to J. Anderton, Esq., for the use of the West of England engine; which request was granted. It is here necessary to observe that this engine is of the same power as the Brigade, but was built under the direction and immediate superintendence of Mr. Connorton, with larger water-ways through the valves and suction passages, which give it a decided advantage when working at high velocities.

A printed "programme of the trial" was placed in the hands of visitors. In the first experiment, the West of England engine was worked with a three-quarter inch jet, its usual working size for great heights; but a gale of wind blowing at the time prevented much display in the way of height. In the second experiment, Mr. Nye's engine and the West of England were each equipped with one 1-8th inch nose pipes, and worked by eighteen men. This size of jet being considerably beyond what the West of England was constructed for, it was expected on all hands that Mr. Nye's engine would show to some advantage. The result, however, disappointed many and surprised all; the West of England jet being delivered alongside the other without any apparent difference, the advantage (if any) being in favour of the West of England. This experiment entirely failed to show the "immense increase of speed and power" which the company had been invited to witness; and still larger nose-pipes were then resorted to, each engine being equipped with 1¼ inch nosel, and again set to work, when to the astonishment of all present, the West of England still "held her own" most triumphantly; the men by the rapidity of their working more than compensating for the inferior capacity of the engine, and pouring forth a perfect torrent of water.* The West of England firemen then attached three lines of hose to their engine, and three five-eighths of an inch jets were simultaneously delivered to a considerable elevation. The novelty of this movement, and the rapidity with which it was executed, gave much satisfaction to the company.

Mr. Nye's invention was next shown applied to a lift-pump, to a pile-driving engine, and to a steam-engine, "showing a 6-inch stroke of the piston producing a 15-inch throw of the crank in," (it is added) "*the same time, and with less power* than would be required to

* It is worthy of remark that the West of England engine had received no preparation for the trial, the firemen and engine having been actively engaged all night at a large conflagration in Bermondsey, where they had rendered most important services.

produce a 3-inch throw of the crank upon the old principle!"

Mr. Nye's invention consists simply in converting a short stroke into a long one by means of *lazy-tongs;* taking a long lever to work a short one, which he eventually converts into a long one by multiplication; *i.e.* by a number of short ones; thereby sacrificing his leverage, and introducing a complexity of parts, entailing enormous friction, increased wear and tear, and great liability to derangement.

Such persons as are still convinced of the truth of the axiom, that what is gained in power is lost in time, will be at no loss to see through the deception which Mr. Nye has practised upon himself, by supposing that he "has obtained an immense increase of speed and power, without increasing the power of the prime mover."

Of the various announcements of Mr. Nye's invitation letter, one, and only one, was unanimously and unequivocally admitted to have been demonstrated by the trial of Saturday—namely, that the *West of England* fire-engine is "*the best in use.*"

EARLY DAYS OF STEAM NAVIGATION.

Charles King, LL.D., President of Columbia College, recently delivered an address before the Mechanics' Society of New York, in which are some very interesting reminiscences of early steam-boat navigation in America. We quote the following condensed abstract from the *Scientific American:*

"Let us go back to 1806, from which dates the era of steam applied to navigation, and the great discovery—for the successful application of a known force in a new manner, and to new and before unthought-of purposes, may justly be styled a discovery—belongs to our city, of which the first Fulton was a resident, and from which the first boat, the *Clermont*, started for Albany on the 7th day of August, 1807. An hour might be readily occupied with the recital of the hopes and the fears, the almost angry doubts and the passionate sneers, with which the announcement was received that a boat without sails or oars was to be forced up the Hudson to Albany, against wind and tide, in a shorter time than was ever dreamed of, and all by the vapour which the housewife's tea-pot sends curling into the air, to vanish in an instant from sight. For, at that time, steam engines as applied to the various processes of manufacturing or other industry on land, were little known of generally, and the whole United States furnished but one machine-shop or foundry where a steam engine could be made, and that was opposite to this city, at Hoboken, in the works of Colonel Stevens, of whom more anon.

"But the *Clermont*, in the sight of a jeering rather than encouraging crowd, got under weigh, and slowly, very slowly, as we now estimate speed, forged ahead; Robert Fulton, and a few chosen friends and faithful mechanics only on board—for he refused passengers generally, only consenting, after much solicitation, to take six, of whom the late Selah Strong was one, and perhaps the first man who ever paid for a steam-boat passage up the Hudson.

"In thirty-two hours, running time, after stopping one night at the seat of R. R. Livingston, the *Clermont* made her appearance at Albany, having received in her fiery track along the river abundant manifestations of interest, astonishment, and even terror—and thereby securing the monopoly promised by the Act of Legislature to any persons who should accomplish the distance by steam between Albany and New York within thirty-six hours. The return trip was made in thirty continuous hours, averaging five miles an hour. The engine of this boat was made in the workshop of the famous Watt, at Birmingham.

"None of the papers at that day described the voyage or alluded to it, but one, *The American Citizen*, edited by an Englishman named Cheetham. The papers were engaged in disgraceful political quarrels, they could not talk of a steam-boat, no, no!

"The palm thus gained by Fulton was closely contested by John Stevens, of Hoboken, who, long in concert with R. R. Livingston and Robert Fulton, has made experiments in steam as a means of propulsion, but now, aided by the genius and practical mechanical skill of his son, R. L. Stevens, was operating separately. Almost simultaneously, but yet behind by that fatal quarter of an hour which determines the fate of so many enterprises, and of so many human beings, both men and women, Mr. Stevens produced, independently of Fulton's plans and experiments, his steam-boat *Phœnix;* but precluded by the monopoly which Fulton's success had obtained for him of the waters of New York, Mr. Stevens first employed her as a passage boat between that city and New Brunswick, and finally conceived the bold purpose of sending her round to Philadelphia by sea; and he executed it successfully. His son, Robert L. Stevens, went round with the boat in the month of

June, 1808. A fierce storm overtook them. A schooner in company was driven off to sea, and was absent many days; but the *Phœnix* made a safe harbour at Barnegat, whence, when the storm abated, she proceeded safely to Philadelphia, and plied many years between that city and Trenton. Mr. Stevens thus earned indisputably the honour of first venturing and succeeding to encounter the might of the ocean with a steam-propelled vessel. When the *Phœnix* went round to Philadelphia, the Atlantic, and no other sea, had ever known the domination of victorious steam.

"The limit, the utmost limit of speed, to which Fulton hoped or thought it possible to attain, was nine miles an hour, and that he did in later boats, but it was again reserved for the name of Stevens, after long and numerous experiments, cautiously conducted and tested, as to the form of vessel best calculated to overcome the resistance of the dense medium through which it was to make its way, to send forth on the Hudson, a boat as superior in size and equipments as in speed to all before it, and to travel at the rate of 13½ miles per hour. Even that is now slow, and the 150 miles which separate us from Albany are passed over by steamboats—not one, but many—in eight or nine hours; and the actual rate of nineteen, and even twenty miles, has been attained by some of the later boats. But when the New Philadelphia, R. L. Stevens' boat, in 1814, started off at the rate of 13½ miles per hour, even the senses were distrusted; philosophy, which had calculated only the resistance of the medium to the forms then used, was at fault, and what had been actually done was pronounced impossible. But the steady, far-reaching mind of the younger Stevens knew the secret of his success—that it was due to the form he had given to his vessel. He saw, too, after some trips, that even that form was far from the perfection he had designed, and accordingly he went to Brown and Bell, then, and even yet, I believe, eminent ship-builders, and begged them to put on the *New Philadelphia* a long, sharp, false bow, of which he gave them the drawing. After considering the proposition, they declined, declaring themselves unwilling to encounter the ridicule of what struck them as so unseemly a work, and Mr. Bell added that it would be called Bell's nose, and would be the general laughing-stock. Repulsed, but not disconcerted, young Stevens, sure of his own conclusions, built a false bow at his own shop, put it on, and obtained in consequence an additional speed of several miles the hour. With the *New Philadelphia* commenced the first day line to Albany. This was the commencement of the new models, which, alike in clipper steamers and clipper ships, have given to both classes of our build and navigation—for there is a great deal, too, in the latter—our superiority over the world.

"By the lucky quarter of an hour, Fulton carried away from Stevens the prize of the first successful steamboat. But years before, viz., 1804, Colonel Stevens, whose fertile and ingenious mind was especially turned to mechanical inventions, had constructed and put into operation a steamboat of which the motive power was a propeller, the propeller which at this day I believe is admitted in form and proportion to be the best. This boat was a small one. In it Colonel Stevens put an engine with tubular boilers, the first ever made, now universal in locomotives. The machinery, made under his own direction and in his own shop at Hoboken, set in motion two propellers, of 5 feet diameter each, and each furnished with four blades having the proper twist—to obtain which he had the greatest difficulty with his workmen—and set at an angle of about 35 degrees. This vessel—used only for testing the possibility of steam navigation—so completely demonstrated the fact, that Colonel Stevens applied it on a larger scale in 1806, to a pirogue, 50 feet long, 12 wide, 7 deep—which attained very considerable speed. Encouraged thereby, he commenced the *Phœnix* with side wheels, to whose success allusion has already been made. It is proof of the remarkable accuracy and skill of the Hoboken workshop, that the engine of the first small propeller, carefully preserved, was set up again not more than ten or twelve years ago, in a new vessel, and, without altering a screw, worked most successfully. The old hull and the blades of the propeller are yet in existence at Hoboken.

"Not the least useful purpose to which steam was applied, about those times, was to the ferry-boats, which dart at all hours across the rivers, separating at once from, and binding us to the shores opposite our Island.

"The first in advance was the introduction of horse-boats, twin-boats with the wheel in the centre, set in motion by a sort of horizontal tread-mill wheel on which horses were made to step. For horses, steam was substituted; first by Fulton at the Fulton Ferry. Then came the single boats, with side-wheels, and propelled by steam, of which the first was the Hoboken, by R. L. Stevens, in 1822. She still is at work, enlarged and as sound as ever, and much faster than at first. As indispensable to the new ferry-boats, came—of Fulton's devising—the floating bridges at the ferries which

rise and fall with the tide, aided by counterbalancing weights on shore; an invention ingenious in itself, and, as I have said, the indispensable complements of steam ferry-boats. The spring piles now used to deaden the force of the blow as the boat approaches the ferry, and to direct her course aright, are due to R. L. Stevens, who introduced them in 1822.

"In the year 1818, the *Savannah*, a New York built ship, with side wheels, and propelled by steam and sails, went hence to Petersburgh, *vià* Liverpool, and returned safely; and a year later, the *Robert Fulton*, built by Henry Eckford, under the superintendence of Jasper Lynch, for David Dunham, plied as a steam-packet between this city and New Orleans, but, the business not paying, her engines were taken out and she was sold to the Brazilian Government as a ship-of-war, being of 700 tons. I have a memorial of this ship, as it were from the grave. [The lecturer here unrolled and exhibited to the audience, a coloured drawing of the *Robert Fulton*, made in 1821—deposited under one of the marble columns erected that year in the South entrance of the Park, and disinterred, uninjured, in 1848, when those columns were removed.]

"Thus, it may be said, in every sense of the word, 'America is the mother of steam navigation,' tubular boilers and propellers."

FELT CLOTH CARPETS.

The *Journal of Commerce* gives an account of a novel production which the Bay State Mills have produced, it is a felt cloth carpet, printed in block work, and designed according to weight either as a floor cloth or drugget. The threads of wool are not spun or woven, but drawn out and laid together, the whole mass being felted like a hat body. Within a few months, fabrics have been put together in this way, showing a different colour on either side, and designed for coats to be made up without lining. The Bay State Mills make this cloth with a white ground, about 40 inches wide, weighing from four to twenty-four ounces per yard, and print it in elegant carpet designs, showing the richest combination of brilliant colours, and furnish it at 75 to 90 cents. per yard.—*Scientific American.*

NEW ILLUMINATING APPARATUS FOR LIGHTHOUSES.

We learn by the *Providence* (R. I.) Journal, that Mr. George F. Wilson, of the Atlantic de Laine Mills, in that place recently gave an interesting lecture before the Providence Franklin Society, upon the Illumination of Lighthouses, in the course of which he explained an improved apparatus invented by himself and Dr. Meacham, of Cincinnati. The improvements are a combination of the dioptric and catoptric methods of illumination. The lamp and reflector is thus described by the Journal:

"The lamp, which is of great illuminating power, has three concentric wicks, the diameter of the larger being two and three-fourths inches, with a separate oil chamber for each, and to which, by a simple arrangement of the conveying tubes, the oil is carried and constantly kept at its proper level, thereby dispensing with the rack-and-pinion for raising the wicks, as well as all the clock-work and pumps heretofore found indispensable in lamps of this kind.

"The reflectors, which are arranged both above and below the light, are constructed upon a die, the form of which is obtained by the revolution of a parabola around an axis perpendicular to its own, and passing through its vortex; and the diameter of the lamp and the focal distance of the reflectors are so graduated to each other, that the most luminous portion of the light shall always be in this universal focus.

"To prevent the escape of any radiant light, a cylindro-plano-convex lens, having the same common focus, is placed between the middle and lower reflectors, which transmits and refracts it in a line parallel to a horizontal plane passing through the light. By this arrangement all the light evolved is thrown out in a horizontal belt, and is equally luminous or brilliant at all points. The whole apparatus, which pleases all who have seen it by its exceeding simplicity, will not cost more thon 300 dollars; and while it would produce a light many times more efficient than the best catoptric apparatus now in use, it would save to our government more than 100,000 dollars annually."—*Scientific American.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING APRIL 28, 1852.

EPHRAIM HALLUM, of Stockport, cotton spinner. *For certain improvements in preparing and spinning cotton and other fibrous substances.* Patent dated October 22, 1851.

Claims.—1. A method of feeding condensing carding engines by the same arrangement as is usually employed with the ordinary lap, but with a lap or laps composed of an indefinite number of coils of slivers,

wound either singly or with two or more slivers together.

2. A method of doubling in spinning frames adapted to spin the produce of condensing carding-engines, by supplying two or more ends to one spindle, whether by means of one row of bobbins, or by means of two or more rows of bobbins, one of which delivers two or more ends to each spindle, and the others one or more ends each; or by means of bobbins having two or more ends laid on to one coil from the condensing carding engine,—all such bobbins being either unpressed or pressed so as to contain a greater length of material in each coil. Also, the same methods of doubling when carried out by means of cans containing rovings from the condensing carding engine, instead of by means of bobbins.

3. A mode of arranging the bobbins in the creels in an alternate position in relation to one another.

4. A mode of causing two bobbins to revolve by contact with one drum.

Joseph Beattie, of Lawn-place, South Lambeth, engineer. *For improvements in the construction of railways, in locomotive engines, and other carriages to be used thereon, and in the machinery by which some of the improvements are effected.* Patent dated October 22, 1851.

Claims.—1. A compound longitudinal bearer, and compound and other rails.

2. The construction of rails in parts, and the arrangements of these parts in various modes specified.

3. A rail formed of three or more elementary parts.

4. An improved construction of chair.

5. A peculiar combination of longitudinal bearings with ordinary rails.

6. A mode of constructing and applying points and switches.

7. The application and use of friction driving-wheels in locomotive engines.

8. Certain additions to engines for promoting combustion.

9. An apparatus for receiving and condensing part of the exhaust steam, and for catching sparks.

10. An apparatus for intercepting and condensing steam from the exhaust pipes.

11. The application of certain pneumatic apparatus to locomotive engines.

12. The use of additional fire-boxes.

13. An apparatus for admitting air to the fire-box and ash-pan.

14. An improved piston.

15. An improved slide valve.

16. A mode of constructing axles or journals.

17. An apparatus for lubricating the journals of axles.

18. Several improvements in wheels.

19. A mode of uniting and coupling carriages.

20. An improved manufacture of wheel tires.

21. An improved arrangement of steam hammers.

22. An arrangement of sawing machinery.

John Platt and Christian Schiele, both of Oldham, machinists. *For certain improvements in machinery or apparatus for the preparation and manufacture of fibrous materials, which improvements or parts thereof are also applicable for the transmission of fluids and aëriform bodies.* Patent dated October 22, 1851.

Claims.—1. The general arrangements of fans, or blowing, or exhausting, or impelling machinery described.

2. A system or mode of blowing, or exhausting, or impelling air, fluids, or aëriform bodies, wherein the current is received and discharged in the axial line of the fan shaft.

3. A system or mode of gradually accelerating and retarding the current in fans, or other impelling apparatus.

4. A system or mode of constructing fans, wherein the passage for the current is the same or equal at all diameters of the disc.

5. A peculiar construction and arrangement of fans, wings, or vanes.

6. The application and use of short wings or vanes, arranged in the spaces between the larger vanes.

7. A peculiar shovel-like formation of the receiving portions of the vanes or wings.

8. A peculiar formation of the receiving edges of the vanes or wings, for preventing the adhesion thereto of loose fibres or other matters passing with the current.

9. A system or mode of preventing "back-lash" or reaction in the air current, by expelling the current against a curved or rounded surface.

10. A system or mode of lubricating spindle and other bearings.

11. The application and use of a return channel for keeping up the flow of oil over the rubbing surfaces.

12. A system or mode of separating foreign matters from lubricating fluids, by the use of a separate reservoir in communication with the bearing or working surfaces.

13. The adaptation and use of cast-iron collar bearings for spindles.

14. The application and use in spindles of cast-iron feet or bottom bearing ends.

15. A system or mode of constructing the beating cylinders of cotton machinery with card teeth or combing wires in combination with the opening beaters or knives.

16. The application and use in heating cylinders of alternate rows of card teeth or combs and beating knives or blades.

17. A system or mode of constructing the cap-shapers of spinning machinery with an intermediate joint.

18. The adaptation and use in spinning machinery of an additional shaping-plate.

DONALD HENDERSON, of Glasgow, ironmonger. *For an improved apparatus for generating gas, which apparatus may be used for heating and other similar purposes, and other apparatus for heating and ventilating.* Patent dated October 23, 1851.

Claims.—1. A gas-producing apparatus to be used in conjunction with a kitchen range, or with a drying and heating stove for the generation of carburetted hydrogen gas, wherein the condensed or first liquid products in the manufacture of gas are returned to the retort or retorts for further distillation, whereby a greater amount of gas is obtained, and the whole of the liquid decomposed.

2. A hydraulic valve applied to the channel through which the liquid products are returned to the retort in order to prevent the escape of gas by that passage, while, at the same time, the liquids have free access thereby to the retort by gravitation.

3. The arrangement of the hydraulic main, condensers, and pipes in connection therewith in such relative positions as will permit the liquid products to return to the retort by gravitation.

4. A safety-valve for the purpose of preventing too great a pressure of gas accumulating in the retort of gas-holders.

5. An arrangement of gas heating apparatus to be applied to baths. (The burners are placed in the interior of a small cylindrical boiler or water-space, at one end of the bath, communicating by pipe, above and below, with the bath. The heated water ascends into the upper part of the bath, and its place is constantly supplied by fresh water from the lower part. The sides of the bath are formed double, and the products of combustion are caused to traverse the flue thus formed, and thereby act to, in conjunction with the burners, facilitate the heating of the water.)

6. A gas ventilating apparatus. (This apparatus consists of a cylindrical double casing with perforated sides, between which the burners are placed. The hollow in the centre of the casing is in communication with the room to be ventilated at its lower part, and with the external air at its upper. The combustion of the gas produces a rarefaction of the air by which the vitiated portions are drawn off, and the ventilation effected.)

JONATHAN SPARKS, of Conduit-street, surgical bandage-maker. *For improvements in or substitutes for laced stockings or bandages for the legs.* Patent dated October 23, 1851.

Mr. Sparks's improvements consist in manufacturing elastic stockings, knee-caps, and such like articles, by weaving them without seam, and of the exact shapes required to suit any particular portion of the leg. The elastic thread which he uses for the weft is composed of vulcanized India-rubber, covered with filamentous material, and the required widening or narrowing of the weaving is performed by a Jacquard or other suitable apparatus, or by the use of a reed, the dents of which are wider apart at their upper than their lower ends.

Claim.—The means described of manufacturing improvements in or substitutes for laced stockings or bandages for the legs.

JOHN HENRY PAPE, of Paris. *For improvements in ploughs.* Patent dated October 23, 1851.

Mr. Pape's improvements in ploughs consist in combining therewith seed-planting machinery and arrangements for throwing earth over the seed, and raking or harrowing the surface of the planted ground. He also applies heat in certain cases to the ground, by means of a hollow roller containing steam. To assist in propelling the machine over the ground, steam may be caused to act so as to protrude from a cylinder in an inclined position a piston-rod, the end of which, by striking against the ground, gives a forward impulse to the machine. With respect to this method of auxiliary propulsion, Mr. Pape observes, that as "ploughmen are not at all accustomed to the management of steam, he does not think it likely that it will ever come into general use;" and he therefore suggests, as an alternative expedient, to ignite successive small charges of gunpowder in the cylinder, the explosion of which would force out the piston or rod, and, by its action against the ground, cause the machine to be moved forward.

ALLEN SEARELL, of Tanybwlch, Merioneth, engineer. *For improvements in sawing machinery.* Patent dated October 23, 1851.

For specification, see first article of the present Number.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Samuel Heseltine the younger, of Harwich, Essex, gentleman, for improvements in engines to be worked by air or gases. April 24; six months.

William Church, civil engineer, and Samuel Aspinwall Goddard, merchant and manufacturer, and Edward Middleton, manufacturer, all of Birmingham, for improvements in fire-arms and ord-

nance, and in projectiles to be used with such or the like weapons; and also improvements in machinery or apparatus for the manufacture of part or parts of such fire-arms, ordnance, and projectiles. April 24; six months.

Armand Jean Baptiste Louis Marceschean, of Rue de Moscow, Paris, France, gentleman, for improvements in the mode of conveying letters, letter-bags, and other light parcels and articles. April 24; six months.

Richard Christopher Mansell, of Ashford, Kent, for improvements in the construction of railways, in railway rolling stock, and in the machinery for manufacturing the same. April 24; six months.

William Exall, of Reading, Berks, engineer, for improvements in the process, composition, or combination of materials, machinery, and apparatus for making bread and biscuits, part of which machinery is applicable to the mixing and kneading of plastic substances in general. (Partly a communication.) April 27; six months.

Alfred Taylor, of Warwick-lane, London, and Henry George Frasi, of Herbert-street, North-road, Middlesex, for improvements in heating and supplying water for baths and other uses, in the construction of water-closets, and in supplying them with water, and in cocks for drawing off liquids. April 27; six months.

William Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in machinery for weaving, colouring, and marking fabrics. (Being a communication.) April 28; six months.

Thomas Richardson, of Newcastle-upon-Tyne, for improvements in treating matters containing lead, tin, antimony, zinc, or silver, and in obtaining such metals or products thereof. April 28; six months.

Charles Fisher, of South Hackney, Middlesex, for improvements in transferring ornamental designs on to woven or textile fabrics, and in the apparatus connected therewith. April 29; six months.

John Lintorn Arabin Simmons, of Oxford-terrace, Hyde-park, Middlesex, Captain in the Royal Engineers, and Thomas Walker, of the Brunswick Ironworks, Wednesbury, Stafford, Esq., for improvements in the manufacture of ordnance, and in the construction and manufacture of carriages and traversing apparatus for manœuvring the same. April 29; six months.

Peter Bruff, of Ipswich, Suffolk, civil engineer, for improvements in the construction of the permanent way of rail, tram, or other roads, and in the rolling stock or apparatus used therefor. April 29; six months.

James Fletcher, of Leyland, Lancaster, bleacher, for improvements in machinery or apparatus for stretching and dyeing woven fabrics. April 29; six months.

John Hinks, of Birmingham, manufacturer, and Eugene Nicolle, of Birmingham, civil engineer, for a new or improved composition, or new or improved compositions and machinery, for pressing or moulding the same, which machinery is also applicable for moulding or pressing other substances. April 29; six months.

George Goodman, jun., of Birmingham, Warwick, manufacturer, for an improved method, or improved methods, of ornamenting japanned metal and papier maché wares. April 29; six months.

Stewart M'Glashen, of Edinburgh, Scotland, sculptor, for the application of certain mechanical powers for lifting, removing, and preserving trees houses, and other bodies. April 29; six months.

John Robinson, of Rochdale, Lancaster, timber merchant, for improvements in machinery or apparatus for shaping wood into mouldings and other forms. April 29; six months.

John Cumming, of Paisley, Renfrew, North Britain, pattern designer, for improvements in the production of surfaces for printing or ornamenting fabrics. April 29; six months.

LIST OF SCOTCH PATENTS FROM 22ND OF MARCH TO THE 22ND OF APRIL, 1852.

Richard Archibald Brooman, of the firm of J. C. Robertson and Co., of 166, Fleet-street, patent agents, for improvements in presses and pressing, in centrifugal machinery, and in apparatus connected therewith, part or parts of which are applicable to various useful purposes. (Communication). March 24; six months.

Colin Mather, of Salford, Lancaster, machine maker, and Ernest Rolffs, of Cologne, Prussia, gentleman, for improvements in printing, damping, stiffening, opening, and spreading woven fabrics. March 24; six months;

James Melville, of Roebank Works, Lochwinnoch, Renfrew, calico printer, for improvements in weaving and printing shawls, and other fabrics. March 29; six months;

Alexander Forfar, of Milnathort, Kinross, builder, for improvements in ventilation, and the prevention of smoky chimneys. March 29; six months.

Joseph Jones, of Bilston, Stafford, furnace builder, for certain improvements in furnaces, and in the manufacture of iron. March 29; four months.

Sir John Scott Lillie, of Pall-mall, Companion of the most Honourable Military Order of the Bath, for certain improvements in the construction and covering of roads, floors, walls, doors, and other surfaces. April 2; four months.

William Watson Pattinson, of Felling New House, Gateshead, manufacturing chemist, for improvements in the manufacture of chlorine. April 2; six months.

George Mills, of Southampton, Hants, engineer, for improvements in steam-engine boilers, and in steam propelling machinery. April 2; six months.

Alexandre Hédiard, of Rue Taitbout, Paris, gentleman, for certain improvements in rotary steam engines. April 5; six months.

Joseph Pimlott Oates, of Lichfield, Stafford, surgeon, for certain improvements in machinery for manufacturing tiles, quarries, drain pipes, and such other articles as are or may be made of clay or other plastic substances. April 6; six months.

Russell Sturgis, of Bishopsgate-street, London, merchant, for improvements in weaving looms. (Communication). April 8; four months.

Richard Archibald Brooman, of the firm of J. C. Robertson and Co., of 166, Fleet-street, London, patent agents, for certain improvements in the treatment and preparation of fibrous and membraneous materials, both in the raw and manufactured state, in applying electro-chemical action to manufacturing purposes, and in the manufacture of saline and metallic compounds. (Communication). April 10; six months.

Thomas Barnett, of Kingston-upon-Hull, grocer, for improvements in machinery for grinding wheat and other grain. April 13; six months.

Charles William Siemens, of Birmingham, engineer, for an improved fluid meter. April 15; six months.

Richard Roberts, of Manchester, Lancaster, engineer, for improvements in machinery or apparatus for regulating and measuring the flow of liquids, also for pumping, forcing, agitating, and evaporating fluids, and for obtaining motive power from fluids. April 16; four months.

William Whitaker Collins, of Buckingham-street, Adelphi, civil engineer, for certain improvements in the manufacture of steel. April 16; four months.

John Hack Winslow, of Troy, New York, United States, iron master, for improvements in machinery for blooming iron. April 16; six months.

William Hyatt, of Old-street Road, engineer, for improvements in applying and obtaining motive power. April 16; six months.

Martyn John Roberts, of Woodbank, Gerard's-cross, Bucks, Esq., for improvements in galvanic

batteries, and obtaining chemical products therefrom. April 19; six months.

François Joseph Beltzung, of Paris, engineer, for improvements in the manufacture of bottles and jars of glass, clay, gutta percha, or other plastic materials, and caps and stoppers for the same, and in pressing and moulding the said materials. April 19; six months.

John Walton de Longueville Giffard, of Serle-street, Lincoln's-Inn, Barrister at Law, for improvements in firearms and projectiles. April 19; six months.

William Gorman, of Glasgow, Lanark, engineer, for improvements in obtaining motive power; which improvements, or parts thereof, are applicable to measuring and transmitting aeriform bodies and fluids. April 20; six months.

LIST OF IRISH PATENTS FROM 21ST OF MARCH TO THE 19TH OF APRIL, 1852.

Thomas Barnett, of Kingston-upon-Hull, York, grocer, for certain improvements in machinery for grinding wheat and other grain. March 22.

Russell Sturgis, of Bishopsgate-street, London, merchant, for improvements in weaving looms. (Communication). March 31.

Alexandre Hédiard, of Rue Taitbout, Paris, gentleman, for certain improvements in rotary steam engines. March 31.

Henry Bernouilli Barlow, of Manchester, Lancaster, consulting engineer, for improvements in preparing and dressing hemp and flax, and in the machinery employed therein. April 5.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
April 22	3224	I. Firkins and Co.	Worcester	Gloves.
,,	3225	F. Ayckbourn	Guildford-street, Russell-square	Apparatus for supporting persons in the water.
23	3226	W. McLennan	Glasgow	Apparatus for moulding and attaching shoe soles.
,,	3227	C. Farrow	Great Tower-street	Self-closing valve.
,,	3228	C. Baker and W. G. Gardiner	Rotherfield-street, Islington; Wellisford, Somersetshire	Fire-escape or servant's safety-guard.
24	3229	J. Murphy	Newport, Monmouthshire	Tyre for wheels.
,,	3930	T. K. Baker	Fleet-street, City	Lever cock or hammer for firearms.
26	3231	F. Mason	Ipswich	Reaping machine.
27	3232	J. B. Palmer	Wednesbury	Mould for projectile.
28	3233	L. N. Le Gras	Tennison-street, Lambeth	Aërated liquor bottle stopper.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

April 23	406	F. Mason	Ipswich	Reaping machine.
26	407	L. Schmitthenner	Agar-street, Strand	Shirt front

CONTENTS OF THIS NUMBER.

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Edited by J. C. Robertson, 166, Fleet-street.

ORTLIEB'S CUT-OFF FOR STEAM ENGINES.

Fig. 1.

Fig. 2.

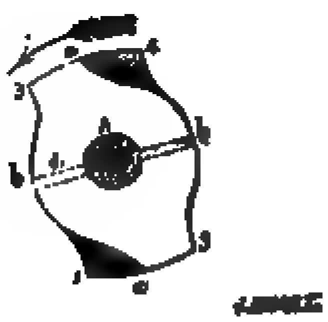

Fig. 3.

ORTLIEB'S CUT-OFF FOR STEAM ENGINES.

The accompanying engravings illustrate an improved cut-off, for operating the valves of steam engines, which has been invented by Mr. Frederick Ortlieb, of Wappinger's Falls, Duchess County, New York. The nature of the invention consists in the employment of a peculiar cam, which is placed on the shaft that operates the slide valve, or its equivalent, or by placing the said cam upon an independent shaft to operate the valve, as will be described. The cut-off valve is also connected by its variations of speed, through the peculiar cam, which is moved on a spindle longitudinally, so as to operate the valve and cut off the steam sooner or later, according to the velocity of the governor, thus regulating the expansion of the steam, and making the engine work at a uniform speed.

Fig. 1 is a front elevation; and fig. 2 exhibits the opposite end of the cut-off cam to that shown in fig. 3, which is a part sectional elevation.

A is the way shaft; it is intended to be driven at the same speed as the main shaft of the engine; it carries the eccentrics B B, to which are connected the rods E E; to them is attached the crosshead of the valve-rod F. C is the peculiar cut-off cam; its form is that of a cylinder with parts of its periphery cut away on opposite sides of its axis, so as to leave two parts *a a* standing full. These standing parts form toes; one edge, 1, of each of these toes is straight and parallel with the axis; the other, 2, runs spirally. The faces of the toes *a a* are parts of the periphery of the cylinder, and are therefore perfectly parallel with each other longitudinally, and with the axis. The least prominent parts, or heels *b b* of the cam are all parallel with each other and with the axis, and form portions of a smaller cylinder than the outside *a a*. The ascent and descent to and from the toes is as sudden as is consistent with the proper action of the cam upon a roller or device, by which the said cam operates the valve-rod; the form of the cam is the same throughout its whole length; it fits easily upon the shaft A. *c* is a narrow slot cut through the shaft A; its length is about that of the cam, and a key-way is cut diametrically through the cam to receive a key *d*, which passes freely through the slot *c*, but fits tightly in the cam. This key prevents the cam from turning on the shaft, but allows it to slide longitudinally. The shaft is bored cylindrically, and is tubular for a great portion of its length. Into the bore of the shaft is fitted a small rod *e*, which is connected to the cam and secured by the key *d*, which passes through it; by moving this rod longitudinally—drawing it or pushing it horizontally—the cam is moved or made to slide backwards and forwards on the shaft. It is by this action that the cam is made to actuate the valve-rod to make it cut off the steam with a shorter or longer stroke according to the velocity of the governor. R is the rod of the cam; P is a lever connected to the rod by an eye hooked over a pin at the foot. This lever is secured on a fulcrum pin; N is a revolving spindle with a bevel pinion M on its inner end; O is a screw or thread cut in this spindle. On the lever P, at its top, is a pin, the inner end of which fits into the threads of the screw. It will therefore be easily perceived that according to the direction in which the spindle N is made to revolve, so will the screw draw in or work outwards the upper end of the lever P, which will so actuate the rod R as to draw the cam to the left, or to the right, so as to make a smaller or greater surface of the toes *a a* act on the roller (as seen in fig. 3) of the valve-rod, to cut off quicker or not, as the case may be. The governor directs this action. On the common sliding collar of the governor there is a bevel pinion K at the foot, and one, L, further up. There are two pins standing up on the inside of the pinion K, and two projecting down from the one, L. In fig. 1 there is a cross pin on the spindle of the governor. It is now revolving between the bevel pinions, and the fixed action of the governor and engine is now represented in the said figure. If the velocity of the governor, however, were increased, the slide collar would be drawn up, the pins of the lower pinion K would be caught by the cross-pin on the vertical spindle, and then the bevel pinion M and K would mesh, motion would be given to the spindle N; the screw would act upon the pin of the lever P, drawing in the upper end of the said lever, thereby thrusting out its lower end, and drawing the cam-rod R, with its cam further out, so as to bring the smaller toe surface to act upon the roller of the vibrating-valve lever D D E, and thus cut off quicker according to the accelerated velocity of the governor beyond the uniform speed, so as to bring back the engine rapidly to the standard speed. When the velocity of the governor falls below the average speed, the slide of it drops, and the upper pinion L takes into M, and revolves in a contrary direction, so as to draw out the pin of the lever P by the screw, and thus push in the rod R to make the larger toe surface of the cam C act on the roller of the valve-rod lever D D E, to give the cylinder a greater quantity of steam to bring it up to the standard speed. It is the intention of the inventor to apply it to the puppet valve, but not limit it to this application. In fig. 3, H is the steam-pipe, which enters a steam-box, in which is the

puppet valve G, which is the one operated by the cam C, and the roller-lever D D E. This steam-box of G opens by the inside pipe H into a common slide-valve box, the valve of which is operated by the eccentrics on the main-shaft, as shown in said figure. The cam revolves in such a direction that the parallel edges, 1, of the toes come first into operation, and these edges operate on the valve at the precise moment the engine is on the dead centre, hence the valve is always open to its fullest extent at the precise moment when the full pressure of steam is required. The valve remains open wide all the time the face of the toe is in operation on the lever-roller. As soon as the edge, 2, of the cam passes the roller, the valve is closed, and so remains till the step in front of the edge, 1, of the next toe comes into operation on it, which it will do just before the conclusion of the stroke, so that the valve may be full open when the engine is on the next centre. The cam opens the valve suddenly and allows it to be closed suddenly, and keeps it wide open till the steam is cut off, and thus this cam is decidedly a very great improvement.

It will be observed by fig. 2 that the spiral line of the cam is so set out that the narrowest ends 3 3, of the faces of the toes shall bear just such a proportion to the half of the circumference of the cam, as it is desired that the shortest portions of the stroke of the piston under full steam, shall bear to the entire stroke say one-eighth; and that the widest parts, 4 4, shall bear the same proportion as the longest part of the stroke, say one-half. The steam will thus be cut off at one-eighth at one end, and one-half at the other. —*Scientific American.*

LOCKS AND SAFES.—THE RECENT LOCK CONTROVERSY.

The recent "lock controversy" has much increased the public interest in this subject, and it is to be hoped that the mechanical spirit which has recently been awakened may be productive of still greater efforts in the improvement of this important piece of mechanism for protecting property. Lock picking will henceforth be more fully contemplated and provided against, in connection with lock-making. For this we may thank our brethren in America. And, perhaps, it is fortunate that the picking of the Bramah Lock has been accomplished at so opportune a moment by Mr. Hobbs, through whose courtesy some light has been thrown upon this mystery, in the lectures at the Banking Institute and before the Society of Arts.

The circumstances under which the lock was opened are well known. It was in the hands of the operator sixteen days, who made use of a fixed apparatus, screwed to the wood-work in which the lock was enclosed, together with the assistance of a reflector, a trunk of tools, and four or five other instruments made for the purpose, having been allowed six or seven weeks previously to take wax impressions of the key-hole. The only legitimate way for Messrs. Bramah to obtain "satisfaction" from Mr. Hobbs, will be to pick *his* lock, U. S. A. No. 298, capable of 1,307,654,358,000 permutations. For a time, Mr. Hobbs' locks (apart from their expense) will stand pre-eminent; considering that the lock picked was fifty years old, should a second challenge upon similar terms, in reference to a modern lock, be declined by Mr. Hobbs, the case will then appear materially altered. Mr. Hobbs will, of course, be willing to offer similar facilities for opening his Prize locks, and if Messrs. Bramah cannot accomplish this within sixteen days, it may be probable that they cannot accomplish it at all. There can be no doubt that the principle of Mr. Hobbs' locks is most excellent, and their execution is highly creditable to America, whose locks at present stand A 1. It will be remembered, however, that his best lock is 50*l.*, whilst Chubb's best lock, with 30 tumblers, is only 15*l.*

Some good must certainly result from this "controversy," and probably the credit of the Bramah principle and execution will in no way suffer, but eventually be advanced by those improvements which will be consequent upon the fact of a highly accomplished American artist having succeeded, after an arduous struggle, in opening them, the facilities afforded him being such as no thief could ever possess, even if he had the necessary ability.

The case, however, has been one of no ordinary picking, and we are much indebted to the perseverance and ability of Mr. Hobbs for the stimulus which, in all probability, will be given to lock manufacture in this country.

The Messrs. Bramah will, of course, improve their lock, and increase its present high reputation. Indeed, the position of the vanquished in *such* a struggle is far from discreditable.

Whilst all locks should be distinguished by security, strength, simplicity, and durability, a very large proportion are not intended, and need not to be constructed with a view to resist actual violence. This

class is useful in the prevention of petty fraud and prying curiosity, and is applicable to all those cases where the certainty of detection would deter from robbery. For the security of valuable treasure, another character of lock should be employed; one calculated not only to resist the secret attempts at tampering, but also the desperate application of main force. The discovery by the Metropolitan Police, in the early part of 1845, of the burglar's instrument called the "Jack in the Box," may well shake our confidence in the apparent security of an iron strong-room door. This instrument is so small in compass, that it might be easily carried about the person, and yet it has the power of lifting three tons weight; this is accomplished by the power of the screw, a turned iron being inserted in the keyhole, a purchase is then gained upon the surface of the door, and either the lock or a portion of the door itself is torn away. Another plan occasionally adopted for opening safes is by the insertion into the keyhole of a burglar's "brace;" this instrument is then forced round, the lock is by this means entirely destroyed, and then the bolt is readily shot back by some instrument, or sometimes by gunpowder. In some cases the "stub" which holds the bolt when it is thrown has been drilled out (its position being generally known); the bolt is thus at liberty. In other cases, burglars have avoided the door altogether, and obtained an entrance to the strong-room by excavation; time, therefore, being granted, it is possible for men to get through almost anything; therefore, in addition to locks, and bars, and bolts, and doors, it is essential that some one or more individuals should be day and night on the premises, wherein property to a large amount is kept. A secure room should be arranged, as near the safe as may be, wherein some one should sleep, with closed and fastened doors—fire-arms forming part of its furniture. The room also should be so constructed that the shutting of the door may not impede the ready perception of the slightest noise: a person in such a case cannot be suddenly surprised by any one concealed within the building, but would have time for thought and preparation should he be disturbed. In addition to this arrangement, of course, the strongest available defence in stone and iron should be used; but it is evident, for the protection of valuable property, they alone are insufficient. A useful addition to the safe-door locks will be found in the sliding-rod, occasionally adopted, which may be lowered from the room above through the safe-door.

Some delicate machinery has been constructed for the purpose of alarms, which are frequently attached to doors and windows, bank-safes, and even *locks*. It has, however, been found that the trouble of nightly adjusting all these instruments, together with the attention necessary to insure their action, and the annoyance caused sometimes by *false* alarms, form a serious objection to their use, and it is thought that if a safe is sufficiently secured, no successful effort could be made to enter it without the person sleeping near it being aroused, especially if aided by a little dog.

It may be well to notice in this place the peculiar suitability of the locks constructed by Mr. Marr, for all safe-doors; these are so constructed that they cannot be affected by the burglar's brace, and no one can open them, even if entrusted with the keys, without being instructed as to the secret of doing so. In Mr. Marr's arrangement, two locks are contained: one is placed behind the other; the hinder one serves to lock the bolt, it having been thrown by the handle. The outer lock, with a second key, then throws a strong hardened steel plate over the keyhole. This is far preferable to the ordinary brass escutcheon locks. The keyholes are placed at right angles with each other, thus making the introduction of picklocks impossible; and the outer keyhole of the door is at right angles with the outer lock. The keys are small, thus preventing the facility afforded by large keyholes for the use of force or cunning. Mr. Marr has very wisely abstained from advertising the principle of his lock, thinking, the less that is publicly known of it the better. In the construction of safe-doors, Mr. Marr protects his locks from being drilled by riveting a number of old files on the back of the door, thus gaining additional strength.

Mr. Hobbs has not had the opportunity afforded him of earning 200 guineas in sixteen days, by exercising his talents upon the locks of Chubb and Son. A lock, however, bearing their name has been picked by him in the presence of Mr. Porter, of the Board of Trade, Mr. Galloway, and other engineers. Messrs. Chubb affirm that this was an old lock of their father's, made under a former patent, without the modern improvements. One particular feature in the Chubb lock is the "detector." This consists of a simple arrangement which is brought into action when either of the "tumblers" is overlifted by a false key or picklock; when this is done, the true key will not unlock it until it has been released. This is done by "reversing the key." This detector system, which is adopted in many locks, may be useful for the discovery of fraud, but the *ready manner* of releasing the detector appears decidedly objectionable, as, on attempt-

ing to unlock the door by the proper key, the hindrance would probably be thought to be accidental, or arising from some misplacement, and in a moment, without reflection, the key would very probably be reversed, and the idea never occur that the detector had been thrown at all. This principle of reversing the ordinary key, in order to reinstate the detector, appears to be adopted in all the detector locks, and its extreme readiness appears a great objection.

The plan adopted in the Chubb locks at the Westminster Bridewell, where 1,100 locks are fixed, forming one series, is far superior when, in case of any surreptitious attempt being made to open a lock, and the detector being thrown, the Governor alone has the power, with his key, to replace the lock in its original state.

The detector arrangement, although possessing some advantages, is not without its evils, especially in locks where the detector is liable to be thrown by the tumbler being very *slightly overlifted*, as in this case, the pressure of the detector commencing almost immediately upon the tumbler being raised to its *proper elevation* for allowing the bolt to pass, may indicate to the lock-picker the character of instrument to be used; and in such locks, when by long use the tumbler springs are considerably weakened, the detector may be sometimes started by a sharp movement of the *proper* key. Where there exists the remotest possibility of this occurring, the detector were far better absent, as the discovery of a detector being thrown is one of grave importance; this danger will be obviated by placing the detector some distance above the ordinary range of the tumblers, and although not quite so much skill may be required for its manufacture, yet the lock of Tann and Sons, which requires that the tumbler should be raised considerably beyond its proper height in order to throw the detector, may be, for that reason, the more really useful lock. It seems that detectors generally should neither be too readily thrown nor too readily adjusted.

Messrs. Tann and Sons' guarded tumbler locks are also provided with a "flange," or "guard," affixed at right angles to the edge of one or more of the "tumblers," thereby covering and entirely protecting the *edge of the "tumbler," above it* from the action of a "pick," and supposing all the "tumblers" but this one to be successfully raised, the bolt could not be moved.

It is very desirable that keys should be made as small as possible, consistently with the power required, that they may be conveniently carried in the pocket; and these locks are distinguished in this particular, the heavy bolts being first shot by a handle in the door.

Where the workmanship of locks is very fine, small keys can be made to shoot large bolts, as is beautifully exemplified in the lock exhibited* by M. Grangoir, 2 inches thick, 10 inches long, and 6 inches deep, having a bolt of 1¾ inch by 1⅛ inch; this bolt is shot out two inches at two revolutions of the key, the key being only 1 inch long, and one-eighth of an inch thick, the handle ring half an inch diameter, and the stub of the key is only one-sixteenth of an inch long; the whole being no longer than a small watch key.

The lock exhibited by Messrs. Barron and Son, with eleven tumblers, appears to correspond very materially in principle with those by Messrs. Chubb; the original patent being, however, for a lock with two tumblers moving in a racked bolt, these tumblers placed in different radii, and the key "bitted" accordingly. In both cases, the bolt is released by the raising of tumblers to a certain height. The detector is also regulated by the proper key when it has been thrown.

The detectors of the lock exhibited by Mr. Gibbons are upon the same principle. Those made by Mr. Woolverson are distinguished by the delicate poising of the detector, by which it is rendered very susceptible.

An apparently superior method of "detection" is afforded in the lock constructed by Mr. Huffer. If a false key is inserted, it is immediately secured by a revolving wheel immediately behind the face of the lock, closing the keyhole entirely; the lock is provided with a second keyhole, having a series of "sliders," which are operated upon by the true key to release the false one.

In this lock, and also in that exhibited by Mr. Foster, there is a curious arrangement for "protection" as well as "detection," for on attempting to tamper with them, *lancets* are shot from the sides of the keyhole, calculated to inflict considerable injury on the hand that would invade it.

Mr. Cotterill's locks are made very scientifically, being, in fact, fitted to the keys, which are all cut unlike one another; the key-cutting machine, Mr. Cotterill asserts, is constructed on the scale of a million to the inch, two keys only being cut whilst the machine is in one position. If the locks are made upon a scale equally exact, it would appear that the alteration in the size of the keys, from *variation of the weather* (!) must

* Crystal Palace.

inconveniently affect their action, and that a key which, at a temperature of 40°, would pass the lock, would, if raised to 70°, throw the detector, which is "easily" released in the ordinary way. It is very desirable that keys should be varied in size, although the value of the difference does not consist in its minuteness.

Mr. Cotterill has some very high testimonials from practical engineers and machinists in reference to the general construction of his locks; and from the indentation in the key being so varied in depth and inclination, it would be extremely difficult to take an accurate impression.

The locks exhibited by Mr. Taylor, called "Improved Balance-detector Lever Locks," have no detector, although called by the name (and perhaps they are as well without). The tumblers are capable of variation, by which a great many "changes may be rung," amounting in one lock, it is said, to two million. The permutation principle, however, is not contained in the key.

Messrs. Gray and Son's may also be called a "permutating" lock, the construction admitting of infinite variations; in the specimen exhibited, to which the prize medal of the Royal Scottish Society of Arts was awarded in 1850, there are two bolts, each operated upon by a different set of "players;" the lock has four players for one bolt, and three for the other; and the distinct positions in which these players may be placed, by fine workmanship, is said to be thirty for each player; and the committee of the Society report that, allowing thirty distinct positions for each player, the number of different locks which might be constructed would be upwards of 22,540,000,000,000,000,000,000,000, thus affording security against false keys; these locks have at present only been made for bank safes, in which case the size is generally about 20 inches square. A 12-lever lock of this description would cost 7*l.* 10*s.*

Mr. Parke's beautiful padlock is a modification of the Bramah Slider Lock.

The Lever Bolt Safety-lock, exhibited by Windle and Blyth, is very peculiar; in addition to racked tumblers, it has a set of "lever bolt guards." The key is in two connected pieces; the "*nose end*" is provided with a "bit" on one side, and the handle part with a "bit" on the other side; the key, being placed in the keyhole, on being partly turned, assumes a different shape, and in this condition, by one bit, withdraws the "bolt guards," whilst the other shoots the bolt itself.

The peculiar principle is also observable in the key of the lock manufactured by Bryden and Sons, which extends outwards after it is inserted in the keyhole, operating upon distant "players." An essential part of the key is also made removeable at pleasure, without which the key is useless.

The elaborate keyholes observed in some of the old locks are abandoned in those of modern date; and thus, the form of the key being more simple, its imitation is perhaps facilitated, and at the same time the lock is more readily examined by a reflector. A beautifully worked specimen of a key and keyhole was exhibited by Mr. Raab; and this may possibly suggest the idea of greater precaution against the imitation of keys—their *possession* for a time by a good workman being all that is required for a *fac-simile* to be produced. Such a key as that above referred to would, however, be exceedingly difficult to copy.

Where it is not required that doors should be locked from both sides, there is little advantage in having a keyhole *through*; this only causing the lock to get sooner dirty, by the constant current of air carrying dust into it. The tampering with a key with burglars' nippers, on the outside of a door, is prevented by the "safety key," exhibited by Mr. Hanley, the end or point of which is made to turn upon a pin, so that the "nippers" are useless.

Messrs. W. and J. Lea have invented some very useful little key-rests, consisting of a brass bracket about an inch square, to which are attached two pliant pieces of steel, curved to receive the barrel of the key; these may be screwed up in a cabinet or closet, one under the other, and keys fixed and removed in a moment, thus admitting of more compact arrangement than the ordinary hooks; prices, according to size, 4*s.* 6*d.* to 9*s.* per dozen.

The splendid lock exhibited by Mr. Downes must not be overlooked; its mechanism is peculiarly beautiful, and for strength and security is very valuable; it is to be placed upon the centre of the door, shooting three bolts from each side, these twelve bolts are secured by "rising bolts," worked by spiral springs, the "rising bolts," also secure four "fly bolts," which are confined by two elliptic springs; the key is in the form of a cross, and, by means of a number of "secret wards," forces the "fly bolts" from their fastenings, at the same time working an eccentric lever wheel, by which the twelve bolts are thrown. The key cannot be withdrawn until the lock is fastened. A lock on this principle might be also made for bank outside doors, shooting two long bolts, one up and one down. For a door three or four feet wide, and seven high, the price would be 18*l.* or 20*l.*

As a specimen of foreign manufacture, the lock exhibited by M. Bergstrom is worthy of attention, and although of rough exterior, on being opened, the interior work is found to be extremely good. It has eight tumblers, and is without detector; price 3*l*.

Letter Locks.—The principle of these locks is very fully carried out on the Continent; most of their iron safes being fitted with them. In some of these, several alphabets are used, and by this means an almost endless "permutation" is obtained. These locks, when of a common description, are anything but safe. From reposing confidence in the *secret* of the lock, less care is naturally taken of the key, which being improperly obtained, the lock may not unfrequently be opened by attaching a weight to one side of the key, and severally turning round the rings until their correct position is discovered. The continental locks, however, are of most excellent construction, but it is quite possible that if, in haste, a person, after having locked the door, should forget to disconnect the letters of the secret word, the "sesame" may be discovered.

This subject must not be concluded without an expression of astonishment and admiration at the exceedingly curious principle adopted in the locks of Mr. Hobbs' invention, manufactured by Day and Newell, and those of Mr. G. Shmedlier, of Vienna; here the "permutations" are not caused by any variations in the construction of the locks, but are produced by the action of the key. It is pretty well known that the part of the key corresponding with that which, in other keys, is usually termed the bit, is in these keys formed of a number of flat rings of iron of various sizes—the relative position of these rings can easily be altered, by removing the end of the key. In the process of locking, the key *forms the lock according to its own shape*, and then no other key will open it. The process by which this is accomplished is not easily understood, much less easily described; a set of steel bars or plates is operated upon by the rings, which, in the passage of the key, are thrown into certain corresponding positions. The key may be varied almost infinitely, and a *fac-simile* lock will be produced.

Safes.—For the purpose of awakening attention to the importance of locks and *safes*, it may be suitable here to quote a passage from the *Bankers' Magazine* for April, 1845:

"In a country where a large class subsist by robbery, and where the means of effecting it securely is the constant study of skilful and ingenious thieves, the only means of baffling them, and of protecting the ordinary depositories of valuables from their felonious attacks, are to call in the aid of the greatest mechanical skill with respect to locks and fastenings, and to exercise unceasing care and vigilance. The bank robberies during late years show that they have been planned with extraordinary sagacity, and have been effected with a degree of skill which proves that they are not undertaken by ordinary thieves. The large amount of money which the housebreakers are confident of obtaining in the case of a successful burglary at a bank, induces them to act with a degree of skill and caution proportionate to the expected booty, and it is for this reason that an unsuccessful attempt to rob a bank is seldom heard of; when "a set" is made at a bank, every information is, in the first place, sought for by the burglars of the means of security adopted, and it has been ascertained that many weeks, and even months, have been occupied in this manner. Attempts are made to tamper with the servants, and an acquaintance is formed, if possible, with some of the female domestics. If, upon inquiry, it is found that the means of security are so numerous and inviolable as to give no chance of success, the matter is quietly dropped; but if any opportunity presents itself, no time is deemed too long to wait for the proper moment when the bank may be entered, the misnamed *safe*, or *strong-room*, be opened, and a clean sweep made of all the convertible securities and money it may contain."

The discoveries in chemistry have done much to promote security from fire; and the sides of safes, when constructed with highly non-conducting chemical preparations, are capable of withstanding a great amount of heat for considerable periods. Many persons have been surprised at the amazing thickness of the safe exhibited by Mr. Leadbeater. This thickness, of nearly 12 inches, is not generally necessary, and is intended for cases where, for convenience, it may be placed in the centre of a warehouse containing large quantities of inflammable matter; the sides are filled with non-conductors. A safe, similar to that exhibited, affording 6 cubic feet of clear space inside—viz., 36 inches high, 24 inches wide, and 12 inches deep—would be 100*l*. Mr. Leadbeater would, however, furnish a safe 3 inches thick at all parts for 75*l*. He has supplied several banks with safes of this description, including London and County Bank, Royal British Bank, Messrs. Walter, Haverfordwest, Mr. Adams, Ware, &c.

No one should purchase a fireproof safe without first reading the interesting pamphlet of fireproof statistical detail, published by Messrs. Milner and Son, safe manufac-

turers, with full particulars of their patent principle, which is founded upon the use of chemical non-conductors, together with the use of water, which, in case of fire, by its gradual conversion into vapour, has a powerful influence in resisting heat. The cost of an outside size banker's safe, 6 feet square and 8 feet deep, would be 200*l*.

The patent fireproof strong-room of wrought-iron is particularly worthy of attention. This is exhibited by Mr. Marr, whose peculiar success in the construction of his locks has been already alluded to. This room, or safe, is 6 feet cube, and the sides, 4 inches thick, are made upon chemical principles of resistance.

Mr. Marr's workmanship is distinguished by stability and care in its execution, and his safes are used by some of the first bankers in the country. One of these was taken red-hot from the ruins of the Royal Exchange, in 1838, when the documents contained were found in a state of perfect preservation.

The fireproof safe of Mr. Kolesch, from Stettin, is singular in appearance, no key-holes being visible, and the locks are so arranged that they cannot be opened, with the right key, by any one unacquainted with the secret. These *secrets* appear generally objectionable on the ground that great reliance may be placed upon them, whilst all the while, perhaps, their existence is known and understood, although the party interested may not be aware of it. The price of this safe is 82*l*. 10*s*.

A beautiful iron safe was exhibited by Mr. Arnheim, from Berlin; this is especially adapted for a *money* safe, on account of its great strength. It is fitted up with iron drawers.

The splendidly burnished safe by Sommermeyer and Co. is very attractive and finely executed, as are also those of M. Verstaen and M. Paublan, from Paris. In these the fireproofing consists in the side being constructed of double iron with wood between; this, as a slow conductor, is very well, although not equal to the chemical combinations in English safes. The price of the two safes exhibited by M. Verstaen are 80*l*. and 140*l*.

Wilder's Patent Salamander Safes seem to possess an equal notoriety in America with Milner's safes here. A very long list of testimonials is presented in their favour, and, on many occasions, they have been subjected to severe fiery tests. The price of the small specimen exhibited is 40*l*.

Locks, and especially *safes*, being considered as amongst the most important articles in the Exhibition connected with banking, will, it is thought, justify their having been thus somewhat lengthily discussed; it must, however, be observed that the "safes" of the Great Exhibition, *as a whole*, are distinguished rather by ornament and beautiful workmanship than by stability and practical utility for banking purposes; they are too small and they are too handsome, and, as a consequence, they are (proportioned to the accommodation afforded) far too costly.

Chemical compounds, which are prepared with great labour and expense, are extremely valuable for safes when these safes are liable to be exposed to fire; but when the property to be secured is so valuable as in banks, it may be desirable to incur some slight inconvenience to place it in a *position* which is in itself fireproof. It is therefore suggested that bankers' safes, especially money safes, should always be *under ground*. If this cannot be arranged, then they should have fireproof floors above and under them, and be so placed that a passage or space should run round or about them, and that no *wooden* fittings or furniture occupy the intermediate space. The safe wall should, of course, be constructed of stone and iron. The next wall to it might be built of hollow bricks, or these hollow bricks filled with sand. A safe by this means must be entirely fire-proof, and if arranged at the time of building, might be but a slight expense. In case such a room was proposed to be built, as an addition to a bank, the floors being already made, a security from fire might be obtained by adopting Mr. Macbay's invention. This consists of "*fusible heads*" attached to the ends of pipes leading fram a cistern of water, or a constantly-charged main; the pipe is made to terminate in several of these sealed "*fusible heads*" which may be placed in any desired position. In case of fire, if the heat is raised to a certain height, these heads are fused, and the water immediately gains vent and deluges the surrounding parts. If for the mere security of *books*, the stone walls might be dispensed with, and the brick used, as it seems hardly necessary that a book-safe should be made specially thief-proof The strong-room just described will be principally suitable for those books of a *valuable character* which have been filled. Those *must be kept dry*, which is not easy in the case of papers confined for years under ground, except by constant fires; and although Mr. Clifford's valuable invention for restoring books and papers may do *much*, it is a better plan to *prevent* the necessity for its use. Although the "strong" room mentioned above may be deemed a sufficient security for even valuable books *when filled*, and on account of its superior dryness be preferred, it seems that books *in use* should be kept

beyond the possibility of fire, as much as bills and bank notes. These, therefore, should go below, and for this purpose, it is suggested that a cellar-room or well, lined and arched with Ridgways' *hollow* bricks, should be constructed, and for convenience, as nearly in the centre of the bank as possible, having a square opening at the top, some distance underneath the floor. That a cubical frame, or cage, of flat bar iron should be formed to correspond in size with the opening, a powerful tackle and windlass being fixed above it. This "cage" might then, by means of "sliding bars," be raised and lowered through the opening into the room below. One side of this cage should be open, into which, when drawn up level with the floor, a barrow might be wheeled, containing the books in daily constant use. The three other sides might constitute a series of book-shelves, externally accessible for those books most frequently referred to by clerks in its immediate vicinity. If the hollow bricks were not found sufficient to keep the room from damp, a stream of hot air from a flue might be occasionally driven through it.—*Mr. Granville Sharp's Prize Essay.*

PRESERVED MEATS AND MEAT-BISCUIT.

Preserved meats are out of favour just now. We hear of little except condemned canisters, which the Admiralty unfortunately have in store. It is the more proper, then, to state, that the evidence before the Jury (Great Exhibition) went to show that it is possible to preserve meat in canisters without undergoing any change, for a great length of time. We had hashed beef, which was excellent, dated back to 1836; we had boiled beef fifteen years old, preserved in canisters, and many other specimens, none of which were changed. It is clear, therefore, that the canister-process of preserving is good, provided you keep a sharp eye on the contractors, and upon those who act under them.

But what is more important than all other preserved provisions, is the meat biscuit introduced among the American exhibitions from Texas, by Mr. Gail Borden. We were told that its nutritive properties were of a very high order; it was said that ten pounds weight of it would be sufficient for the subsistence of an active man for thirty days—that it had been used in the American Navy, and had been found to sustain the strength of the men to whom it had been given in a remarkable degree. Statements were made to us, which have since been corroborated, that it would keep perfectly well, without change, under disadvantageous circumstances. Colonel Sumner, an officer in the United States Dragoons, who had seen it used during field operations, says he is sure he could live upon it for months, and retain his health and strength. The inventor, he says, names five ounces a day as the quantity for the support of a man; but he (Colonel Sumner) could not use more than four ounces, made into soup, with nothing whatever added to it. The substance of these statements may be said to amount to this, that Borden's meat-biscuit is a material not liable to undergo change, is very light, very portable, and extremely nutricious. A specimen placed in the hands of Dr. Playfair for examination, was reported by him to contain 32 per cent. of flesh-forming principles; for it is a composition of meat—the essence of meat, and the finest kind of flour. Dr. Playfair stated that the starch was unchanged, that, consequently, there could have been no putrescence in the meat employed in its preparation, and that the biscuit was "in all respects excellent." It was tasted—I tasted it—the Jury and others tasted it; and we all found nothing in it which the most fastidious person could complain of; it required salt or some other condiment, as all these preparations do, to make them savoury. This meat-biscuit, as I said just now, was reported to be capable of keeping well—and this might well be true—because no foreign matter had been introduced into its composition; there was no salt to absorb moisture, and nothing else to interfere with the property of flour, or of essence of meat. These biscuits are prepared by boiling down the best fresh beef that can be procured in Texas, and mixing it in certain proportions with the finest flour that can be there obtained; it is stated that the essence of five pounds of good meat is estimated to be contained in one pound of biscuit. That is a material of the highest value there can be no doubt; to what extent its value may go, nothing but time can decide; but I think I am justified in looking upon it as one of the most important substances which this Exhibition has brought to our knowledge. When we consider that by this method, in such places as Buenos Ayres, animals which are there of little or no value, instead of being destroyed, as they often are, for their bones, may be boiled down, and mixed with the flour which all such countries produce, and so converted into a substance of such durability that it may be preserved with the greatest ease, and sent to distant countries, it seems as if a new means of subsistence was actually offered to us. Take the Argentine Republic,—take Australia, and consider what they do with their meat there in times of drought when

they cannot get rid of it whilst it is fresh,—they may boil it down, and mix the essence with flour (and we know they have the finest in the world), and so prepare a substance that can be preserved for times when food is not so plentiful, or sent to countries where it is always more difficult to procure food. Is not this a very great gain?—*Professor Lindley—Lect. Soc. of Arts.*

Dried Vegetables.—Plantains, Cabbages, &c.

In Mexico, dried plantains enter largely into the consumption of the people in the mining districts. Dried plantains possess considerable nutritive value, and are at the same time exceedingly agreeable to the palate, while they are cheap and easy to prepare. But what I would more especially mention in respect of them is, that the plantains which lie there, perfectly sweet, and having undergone no material change whatever up to the present time, were sent into a baggage-warehouse at Woolwich, in the year 1835, and had there been lying till they were transferred to the Exhibition building. So that it appears that dried plantains are not only exceedingly good to eat, and highly nutritive, but have the property, which many such substances do not possess, of keeping for a very long time,—a fact that should interest those who deal in figs, and similar articles, which are apt to become mity, and dry, and to spoil, to the loss of those who own them. It is certain that there is no good property belonging to the fig which does not also belong to the dried plantain. It appears from the statements of Colonel Colquhoun, to whom we owe our knowledge of the preparation, that such dried plantains can be prepared in Mexico, and sold in Europe for threepence a pound, allowing 10 per cent. profit, supposing there is no duty on their import.

The Great Exhibition contained also some examples of dried vegetables, prepared by what is called Masson's process. The mode of preparing these vegetables is shortly as follows:—they are dried at a certain temperature (from 104° to 118°), which is neither so low as to cause them to dry slowly nor so high as to cause them to dry too quickly; if the last happens, they acquire a burnt taste, which destroys their quality. They lose from 87 to 89 per cent. of their water, or seven-eighths of their original weight; after which they are forcibly pressed into cakes, and are ready for use. I saw, a year ago, the original of a letter from the captain of the *Astrolabe*, a French vessel of war, speaking in the highest terms of the supply of these vegetables for the use of that vessel during her voyage: the French navy generally mentions them in the most favourable terms, and no reason appears for doubting such statements.—*Professor Lindley.*

BOWER'S REGISTERED GAS-COOKING STOVE.

(George Bower, of St. Neots, Huntingdonshire, Ironmonger, Proprietor.)

Fig. 1. Fig. 2.

Description.

Fig. 1 is a front elevation of this stove; fig. 2 another elevation with the doors open; and fig. 3 a top plan. A A are the compartments for holding the articles to be cooked; B B are the gas-burners; and C C, the pipes by which the gas is supplied to them. D D are a set of studs which project upward from

Fig. 3.

the upper surface of the top, and which serve as supports for any boiling apparatus. E E are the burners for heating such boiling apparatus. The outer case, F F, as well as the doors, have an air-space in them, to preserve the heat.

BALEEN.—WHALEBONE.

I have next to speak of a substance which, though commonly called "whalebone," has nothing of the nature of bone in it, but is an albuminous tissue, nearly allied to hair and bristles, both in its chemical and vital properties and its mode of development.

Of all the creatures which man has subdued for his advantage and use, that which surpasses every other animal in bulk, and which lives in an element unfitted for man's existence, might be supposed to be the last that he would have the audacity to attack or the power to overcome. The great whales that "tempest the ocean" are able, as many instances—and a very recent one—have shown, to stave in the bottom of a ship by a blow of their muzzle, and crack a boat by a nip of their jaws, as easy as we would a nut. "Si sua robora norint!"—if they did but know their strength, and how to use it, pursuit would be in vain, and whales would become the most dreaded instead of the most coveted of the denizens of the deep.

The cetaceans, which afford the whalebone, or, more properly, baleen-plates, are of a more timid nature than the great sperm-whales, which commonly cause the catastrophes alluded to; they have no teeth, but, in their place, they have substitutes in the form of horny plates, ending in a fringe of bristles—a peculiarity first pointed out by Aristotle.* Of these plates, properly called "baleen," the largest, which are of an inequilateral triangular form, are arranged in a single longitudinal series on each side of the upper jaw, situated pretty close to each other, depending vertically from the jaw, with their flat surfaces looking backwards and forwards, and their unattached margins outwards and inwards, the direction of their interspaces being nearly transverse to the axis of the skull. The smaller subsidiary plates are arranged in oblique series, internal to the marginal ones. The base of each plate is hollow, and is fixed upon a pulp developed from a vascular gum, which is attached to a broad and shallow depression occupying the whole of the palatal surface of the maxillary, and of the anterior part of the palatine, bones. The base of each marginal plate is the smallest of the three sides of the triangle; it is unequally imbedded in a compact subelastic substance, which is so much deeper on the outer than on the inner side, as in the new-born whale, to include more than one-half of the outer margin of the baleen-plate. The form of the baleen-clad roof of the mouth is that of a transverse arch or vault, against which the convex *dorsum* of the thick and large tongue is applied when the mouth is closed. Each plate sends off from its inner and oblique margin the fringe of moderately stiff but flexible hairs which projects into the mouth. The bases of the baleen-plates do not stand far apart from one another, but the anterior and posterior walls of the pulp fissure are respectively confluent with the contiguous divisions of the bases of the adjoining plates at their thin and extreme margins, which by this confluence close the basal end of the interspace of the baleen-plates, which interspace is occupied more than half-way down the plate by the cementing substance, or gum. Thin layers of horn in like manner connect the contiguous plates, and may be traced extending in parallel curves with the basal connecting layer across the cementing substance.

The baleen-pulp is situated in a cavity at the base of the plate, like the pulp of a tooth; whilst the external cementing material maintains, both with respect to this pulp and to the portion of the baleen plate which it develops, the same relations as the dental capsule bears to the tooth. According to these analogies, it must follow that

* The Passage occurs in the 12th chapter of the 3rd book of the "Historia Animalium," and has given rise to much speculation and controversy:—"Mysticetus etiam pilos in ore intus habet vice dentium, suillis setis similes." To a person looking into the mouth of a stranded whale, the concavity of the palate would appear to be beset with coarse hair. The species of *Balaenoptera*, which frequents the Mediterranean, might have afforded to the father of Zoology the subject of his comparison.

only the central fibrous or tubular portion of the baleen-plate is formed, like the dentine, by the basal pulp, and that the base of the plate is not only fixed in its place by the cementing substance or capsule, but must also receive an accession of horny material from it.

The baleen-plates are smallest at the two extremities of the series; in the Southern whale (*Balæna Australis*) they rapidly increase in length to the thirtieth, then very gradually increase in length to about the one hundred and fortieth; from this they as gradually diminish to the one hundred and sixtieth plate, and thence rapidly slope away to the same small size as that with which the series commenced. Besides the external, and, as they may be termed, the normal, plates, which have just been described, there are developed from the inner part of the palatal gum, in the *Balæna Australis*, a series of smaller fringed processes, progressively decreasing in size as they recede from the large external plates: the small plates clothe the middle region of the palate with a finer kind of hair, against which the surface of the tongue more immediately rests; they are also arranged in longitudinal series, which, however, are not parallel with the external one, but pass from the inner margin of that series in oblique lines inwards and backwards.

In the great Northern whale (*Balæna mysticetus*) the baleen plates which succeed the large ones of the outer row, are more numerous, and are relatively longer and larger, than in the *Balæna Australis*. Mr. Scoresby, who, in his account of the *Balæna mysticetus*, notices only the marginal plates, states that they are about two hundred in number on each side; the largest are from 10 to 14 feet, very rarely 15 feet in length, and about a foot in breadth at their base. These plates are overlapped, and concealed by the under lip when the mouth is shut. In the *Balænopteræ*, or fin-backed whales, the baleen-processes internal to the marginal plates, are fewer and smaller than in the true whales (*Balænæ*). The marginal plates are more numerous, exceeding three hundred on each side; they are broader in proportion to their length, and much smaller in proportion to the entire animal; they are also more bent in the direction transverse to their long axis.

Each plate of the baleen consists of a central, coarse, fibrous substance, and an exterior compact fibrous layer; but this reaches to a certain extent only, beyond which the central part projects in the form of the fringe of bristles. The chemical basis of baleen, according to the experienced Professor Brande, is albumen hardened by a small proportion of phosphate of lime.*

The final purpose of this singular armature of the upper jaw of the great whales is to secure the capture and retention of the small floating mollusks and crustaceans, which serve principally as their food. When the capacious mouth is opened, the water rushes in, and is strained through the fringed surface of the roof and sides, whilst the small animals are retained, bruised against the stiff bristled margins of the plates, and swallowed.

Baleen, or whalebone, from its tenacity flexibility, elasticity, compactness, and lightness, is applied to a great variety of useful purposes. These were well exemplified in the collection exhibited under No. 103, Great Exhibition, by Mr. Henry Horan, which showed well-selected examples of whalebone plates from the Arctic whale (*Balæna mysticetus*), which yields the largest and best kind; from the Antarctic whale (*Balæna Australis*), which affords the second best kind; and from the great finner whale (*Balænoptera boops*), which affords the shortest and coarsest plates. With these examples of the raw material, Mr. Horan exhibited specimens of the raw material in various states of preparation, and numerous and ingenious applications of the prepared baleen, dyed of different colours, as, *e.g.*, for covering whip-handles, walking-sticks, and telescopes, and in the form of shavings for platting, like straws, in the construction of light hats and bonnets. An excellent and instructive series of preparations of baleen was also exhibited by Messrs. Westall, in which was more especially deserving of notice the great variety of filamentary modifications of the whalebone material for numerous useful applications. Fine blades of whalebone from the *Balæna mysticetus* were exhibited in the United States department, under No. 531, by Mr. L. Goddard; and characteristic specimens of baleen-plates from the *Balæna Australis* had been transmitted by Mr. S. Moses from Van Diemen's Land.—*Mr. Owen's Lecture—Society of Arts.*

CLOCK AND WATCH MAKING.

Professor Cowper illustrated by diagrams and models, the principles of the teeth of wheels laid down by Camus, Professor Willis, and others, and particularly urged on manufacturers (many of whom were present) the importance of accuracy and correctness of

* For the microscopical characters, and other particulars of the baleen-plates, I must refer to my "Odontography," vol. i., p. 311.

form; and also the importance of making the greater part of the action of the teeth take place after passing the "line of centres" (*i. e.* a line from centre to centre of the wheels). It was shown that when a toothed wheel drives a *pin*-wheel, the action is entirely behind the line of centres. Thus, in a common Dutch clock the pinions are made with wires, and the toothed wheel drives these pinions with so little friction that they scarcely ever wear out.

He then begged the manufacturer to consider the fact that the Dutch or Germans supplied the *kitchen* wooden clock; the Swiss supplied the *ladies'* pretty flat watch; the French supplied the *drawing-room* ormolu clock; and the Americans are beginning to supply the *counting-houses*; and he urged them to endeavour to meet their demands.

Some observations were made by Mr. G. F. Hall and Mr. Varley on the deterioration, in the course of time, in the strength of springs. It is well known to clockmakers that the "blueing" is essential to the stiffness of a spring; and as, by oxidation or any other cause, the blue wears off, the elasticity of the spring becomes gradually less. Mr. Dent has made some experiments quite corroborative of this.

Mr. Bennett said that American clocks and Geneva watches had been mentioned. It would be a great benefit in every way if we could rival these very cheap, and, on the whole, very good timekeepers. He had made many efforts to do so. To this end he had relinquished the use of the fusee, had reduced the number of wheels to three or four, and had struck or punched the dial-plates in the manner of the American dials. Still he had been unable to produce his clocks at as low a price as theirs. The Americans sell a clock and case for less money than an English cabinet-maker can make the case alone. This and the expense of the mainspring were the difficulties which caused his failure. The Swiss watches are not the best, but still they are very good timekeepers, and they are made for about two-thirds of the cost of ours. The cause of this is the employment of labour, subdivided and encouraged to the last degree. They never employ, as we do, about a hundred men on the different parts of a watch; but many of the parts are made by the women and children of the families. They also show themselves superior to us in adopting improvements, from whatever quarter they come, instead of resisting them as the English workmen do. He did not hesitate to say, that he was never above appropriating an idea or an improvement, provided it were likely to be of service to his work.

The Chairman, W. F. Cooke, Esq., said that one reason for the greater expense of our watches had been overlooked, and that was the natural preference felt by Englishmen for thoroughly well-made articles. But it was wrong to speak as if there had been no reduction in the cost of clocks and watches; there had been a proportionate reduction during late years to that of most other articles of manufacture. He could corroborate, from his own knowledge, what had been said of the subdivision of labour in Switzerland. He had seen the same men working on the farms in the morning, and in the evening with their wives and children employed in their cottages on watch-work around one central lamp.

Mr. Loseby thought that too much stress had been laid by Professor Cowper on the exact epicycloidal shape of the teeth in watch-work. In such minute work it was all but impossible to obtain a shape theoretically correct; and, indeed, was the advantage so great? Watches in which the epicycloidal shape had not been attempted, kept time well and had lasted long.

Mr. Charles Frodsham differed entirely from Mr. Loseby. His experience had shown him that attention to the exact shape of the teeth was of the greatest importance. For example, the deposit which is so often found about the centre-wheel of a chronometer is from nothing else but minute particles of metal worn off from the teeth, owing to their not being of the correct shape. Moreover, he had found that a mainspring applied to a chronometer in which the teeth were accurately cut, gave a much greater effect than it had in one in which they were carelessly cut, and after twelve months' working the wear and deposit had been much less. He had frequently found the teeth both of watches and clocks worn into an approximation to the true curve; and further, he knew of a clock in which the teeth had been properly cut which had been at work for fifty years without any perceptible wear. Lowden had fallen into the error, into which Mr. Loseby seemed inclined to follow him, of thinking that an isochronal adjustment of the balance-spring would be a cure for all the evils of bad workmanship in a watch. The isochronal adjustment was a highly ingenious thing and an admirable safeguard, but it would be far better not to require it. He was so sure on this point, that he had no doubt the main reason why, in two chronometers of equal reputation, one surpassed the other, was, that in that one the curves of the teeth had been truly cut.

Mr. G. F. Hall said that whatever the escapement or form of teeth, a correct judg-

ment might be formed of different clocks by ascertaining the relation which the weight of the pendulum bears to the weight or power required to keep the clock going. Thus, assuming that where these are equal the clock is of a medium quality, we may make the rule that, as the weight or power is a higher fraction of the weight of the pendulum, so is the clock more perfect as a measurer of time. In the most carefully-finished clocks of the present day, the relation is $\frac{16}{4}$, 16 representing the weight of the pendulum, 4 that of the power. A comparison of this with the proportion in the common clocks, or even in the best commercial French clocks, shows at once the great difference between them. The better sort of German or Dutch clocks to go eight days are generally provided with a weight of 14 pounds, while the pendulum rarely exceeds 4 ounces, in which case the fraction will be $\frac{224}{4}$. Nor are French clocks of commerce often of a higher quality. Reducing these fractions, we have for the best astronomical clocks of the present day, 1; and for the common household clocks, ·004465 nearly. If power could be transmitted through the train without variation, this difference between the weight of the pendulum and the weight of the power would be of little importance; but mathematical accuracy, in transmitting uniform power through wheels and pinions, cannot be obtained, and therefore it becomes of the highest consequence. The available force to keep up the vibration of the pendulum in the best astronomical clocks is, after deducting friction, about 1 grain to each vibration. Taking, as before, the weight of the pendulum at 16 pounds, we have $16 \times 7000 = 112{,}000$ grains kept vibrating by 1 grain $= \frac{1}{112000}$. It is not this small fraction of the weight, however, which is of immediate importance, but the variation of it, arising from the impossibility of making the wheels and pinions mathematically true and concentric, whence each tooth is a lever of a different value from its neighbour. In pinions, owing to their small diameter, and to the process of hardening, tempering, and straightening, this difference is considerable. From this and other causes, a train will always vary as much as 4 per cent., in which case the impulse will range from 1·02 grs. to ·98 grs., the extreme difference being $\frac{4}{100}$ths of a grain. It will now be evident how the heavy pendulum and the light weight are better than the reverse; for in the former we have the variation $= \frac{\cdot 04}{112000}$, which is increased in the latter to $\frac{8}{112000}$. The variation is thus magnified two hundredfold, the clock mechanism remaining the same in all other respects. But in common clocks the variation of the train is often more than 30 per cent., enough totally to destroy the synchronism of a light pendulum.

Mr. Frodsham said that the principle of small power and heavy balance, which Mr. Hall had been advocating, was that of the old clock-makers; but he thought it erroneous, though he had abandoned it reluctantly. The clock which would go with the least power would be thereby shown to be mechanically correct, but that would not prove it to be so horologically; for it was always the case in practice, that if the arc of vibration shortens, the vibration is quickened, and therefore it becomes of importance to have more power than is absolutely necessary at hand to overcome accidental impediments, such as even the mere thickening of the oil by temperature. He mentioned the case of two clocks in which he had increased the weight with very great success.

Mr. Bennett would recur to what he had said on a former occasion. He wished to see our watchmakers in a condition to be able to supply the general trade with improvements that were being made with watches for the most scientific purposes. The question to be solved was, how to produce a better-going watch, and at a lower price than heretofore; and he wished not to speak of chronometers, but of watches for the multitude. Our chronometers cannot be beaten; but it is of little consolation to know that fact, if our common watches are not improved thereby. Now, in lamenting as he had done on the former evening the lack of intelligence in our workmen, he had certainly spoken from his own experience. We have no systematic education for our workmen, while the Swiss are bound by law to give a certain competent education to their sons. Again; unless we subdivide labour to at least the same extent as they, we shall not compete with them. Their principle is to make each operation so simple and certain that it can be thoroughly well performed by a work of only small power, or even by a boy, whilst his constantly repeating the same thing gives him almost unerring accuracy. Again; many parts of the Swiss watches are made by women, who are yet able to perform all their domestic duties; and in this it would be very well if we could imitate them, for men have to become half women before they can become thoroughly accustomed to a confining and sedentary employment, which is unnatural and constitutionally hurtful to them; and there are many parts of a watch in which a woman's delicate fingers are far

fitter than a man's. He could not forget the frightful disclosures which had been made by Mr. Mayhew and Mr. Sidney Herbert as to the employment of females in departments of trade quite overstocked with them, nor how essential these disclosures had proved it to be that some other field should be found for their labours. In what he had said, he was not speaking without experience; he sold about three foreign watches to one of English make, a proportion which is increasing; and though this is so, yet the duty on their import is decreasing, proving, what is no secret, that a large number are smuggled over.

Mr. Frodsham said that, from facts which had come within his knowledge, he was quite sure that, *cæteris paribus*, we can compete with the world in watch and clockmaking. The common Swiss watches are but flimsy, and will last but a few years, while they are extremely expensive to repair if damaged. He had been employed some time back to make some watches for the Sikhs; they weighed 2¼ ounces each, and after they were made, he had shown them to a Geneva maker, who had confessed that they could not be made in Geneva for nearly the same price as he (Mr. F.) had charged. Nor can they compete with us in Paris (the weight and workmanship being equal) within 100 per cent. It is surely no discredit to say that good watches cost more than those which contain less of the precious metal, or are only gilt to the thinnest possible degree? The jewels in them are often false, and, indeed, scarcely any species of deception is left untried that will reduce the cost price and make them bear a higher rate of profit. It did not appear to him that subdivision of labour was wanted so much as accurate intelligent superintendence. We did not require workmen so much as horological architects.

It is a well known fact that the best English chronometers and watches were full 100 per cent. cheaper than those of comparative merit produced abroad. And so great is the value of the best English chronometers and watches in the foreign market, that it is utterly impossible to make way against them; and so great is the demand for them, that merchants are content to allow their orders to stand for twelve months.

Mr. Frodsham has recently revised the whole system of watchmaking, which he believes will tend still further to improve their quality and reduce their cost.

The Chairman observed that there was doubtless an increasing desire on the part of the people to buy cheap watches; and if so, they will be obtained from one market or another. It was therefore important that we should be able to make them. He could not speak with regard to watchmakers; but amongst other branches of mechanics, he knew the intelligence was on the increase As regarded compulsory education, alluded to by Mr. Bennett, he believed that it did not succeed. In the canton of Vaud the law fines every parent who does not send his child to school, and yet far fewer are sent to school in that canton than in the canton of Geneva, in which there is no compulsory law.—*Minutes of Transactions of Society of Arts.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MAY 6, 1852.

Henry Adcock, of Northumberland-street, Strand, civil engineer. *For improvements in the manufacture of pipes, chimney-pots, and hollow vessels; also bricks, tiles, copings, columns, and other articles used in building houses and other structures.* Patent dated October 23, 1851.

Mr. Adcock's improvements consist in manufacturing the articles enumerated in the title from the stone, rock, or stony material known as basalt, trap, rowley-rag, whinstone, and others of the same geological genus, by melting the same, and then running the melted material into suitably-shaped moulds.

For the purpose of melting the basaltic rock, a reverberatory or other suitable furnace may be employed, and the materials may be either melted in pots or crucibles or on the bed of the furnace. The moulds employed are preferred to be made of metal, and when casting, they are brushed over inside and out with casters' "blacking." When a polished or smooth surface is desired to the article to be cast, the interior of the mould is polished with black-lead. It is preferred in casting to heat the moulds even to such an extent as to retain the material in a fluid state after it has been poured into them; or the material may be kept fluid in the mould by the direct application of heat. According to the heat employed, and the length of time occupied in cooling down the articles, so will their character or structure be modified.

When a high degree of heat is employed, and the cooling very gradual, the casting will have a solidity and fracture nearly approximating to that of the original material; with a less degree of heat and more rapid cooling, the article will acquire a character and texture closely resembling that of marble; and with a still more rapid cooling, the products of the melted materials will be a rough semi-transparent kind of glass. In

all cases the cooling down should be gradual, and when pipes or cylinders are cast, the core should be removed when the material has set, to allow for its proper contraction in cooling. To facilitate the removal of the core, it may be constructed in several pieces, as is now frequently practised by casters in metal.

When the material is particularly refractory, or rapid fusion is required, it may be found necessary to employ soda, or some other material, as a flux; but, as a general practice, it is recommended to adopt the method above mentioned, and to dispense with the use of fluxes of any kind.

Claim.—The melting of the materials mentioned, and the running of them into suitable moulds to obtain castings of the same.

WILLIAM ADOLPHUS BIDDELL, of St. John's-square, founder, and THOMAS GREEN, of Trafalgar-square. *For certain improvements in moulding, casting, ornamenting, and finishing surfaces.* Patent dated October 29, 1851.

These improvements consist in coating or covering, or overlaying the surface, or parts of the surface of a metal frame or skeleton with glass, porcelain, earthenware, or metal, and in finishing the same by polishing, or polishing and glazing, so as to produce an ornamental surface thereto.

One example which the patentees give is that of a metal plate perforated with holes, which they fill up with potters' materials in a plastic state. They then place the plate in a kiln to biscuit, and having polished the surface of the metal, they cover the plate with enamel, which they fuse when dry. The appearance of the plate when taken from the muffle will be that of earthenware or porcelain inlaid with metal.

Ornamental bricks may be made by laying ornaments made from glass or porcelain on to the surface of a brick, and then filling the interstices of the surface with slip or potters' material of a different colour from that employed for producing the ornamental designs.

Cast iron may be coated with brass, or wrought iron with cast iron. The surface of the metal to be coated is to be pickled in dilute acid, and then immersed while hot in a solution of tin, bismuth, and acid, after which the coating metal is poured on. The method of coating cast iron with brass may be applied to the manufacture of cannon.

Claim.—The several combinations of processes for moulding, casting, ornamenting, and finishing articles and surfaces.

MICHAEL SCOTT, of John-street, Adelphi, civil engineer. *For improvements in punching, riveting, bending, and shearing metals, and in building and constructing ships and vessels.* Patent dated October 30, 1851.

Claims.— 1. Certain improvements in machinery for punching, riveting, bending, and shearing metals. [Mr. Scott describes, firstly, an arrangement of machinery for punching, in which hydrostatic pressure is employed to actuate a plunger to the end of which the punch is attached. A spring serves to bring back the plunger and punch to its position of rest after a stroke has been made, and at the same time forces out the water employed to produce that stroke. The same machinery may be applied to riveting and shearing by substituting suitable tools for the punch. Secondly, an arrangement for multiplying the effect produced by a moderate head or fall of water, by causing the water to actuate the pistons of two or more cylinders simultaneously, and transferring the power thus obtained to a ram or plunger working in another cylinder, and through that plunger to the working of punching or other machinery. Thirdly, a method of bending plates of metal by causing water to be pumped in on a sheet of metal placed between two dies, so as to cause the metal to be forced against and assume the shape of one of the dies.]

2. A mode of constructing ships or vessels with two thicknesses of metal at a distance from each other. [The intermediate space to be filled with cocoa-nut fibre, saturated with bituminous or asphaltic materials.]

3. A mode of fixing wood sheathing to iron ships or vessels. [When the ship is composed of two thicknesses of metal, a hollow rivet is employed to connect the two thicknesses to each other, and a plug of wood inserted in the hollow of the rivet, and the sheathing is then attached by means of bolts or nails driven into the wood. When the sides of the vessel are single, tubes are inserted, into which plugs of wood are driven, and the sheathing is then secured to these plugs as before.]

4. A mode of connecting plates in building boats, ships, and other articles. [The meeting edges of the plates are bent away from each other, a gutter-shaped piece of metal is then threaded over the edges of the plates, and the whole compressed between rollers, by which a secure joint is produced.]

5. A mode of constructing masts for ships and vessels. [These masts are constructed of two concentric tubes composed of plates of metal riveted and stayed together, and the interstices between the tubes are filled with cocoa-nut fibre saturated with asphalte or bitumen.]

6. A mode of constructing ships and vessels to carry cargo in bulk, such as coals. [These vessels have two wells—one forward, one aft—connected together by a tunnel, and the floor of the vessel is raised on each side of the tunnel. The space between the real floor and false floor on each side of the tunnel may be used to contain water for ballast.]

George Fergusson Wilson, manager of Price's Patent Candle Company, Vauxhall; David Wilson, of Wandsworth, Esq.; James Childs, of Putney, Esq.; and John Jackson, of Vauxhall, gentleman. *For improvements in presses and matting, and in the process of, and apparatus for treating fatty and oily matters, and in the manufacture of candles and night-lights.* Patent dated November 3, 1851.

1. The *first* improvement in presses consists in employing in a hydraulic press more than one ram or plunger. The patentees describe an arrangement where two concentric rams are used. The oil cylinder occupies a vertical position in the press, and is perforated at the sides for the escape of the oil expressed during the working of the machine. The method of working is as follows:—The capital or head of the press being removed, the rams are raised to the level of the top of the cylinder, and a perforated plate of metal covered with a matting of cocoa-nut fibre is laid thereon. On this is placed a certain quantity of the materials to be pressed—then another plate and mat—then more materials, and so on. While the materials are being supplied, the rams are gradually lowered by a portion of the water being allowed to escape until the cylinder is filled with the materials to be pressed. The capital of the press is then fixed on, and the pumps set to work to raise the smaller ram and consolidate the materials without exerting much pressure. The rams are then again lowered, and the capital removed, when the space produced by the consolidation of the materials in the cylinder is filled up with fresh layers, the capital again fixed on, and pressure applied to the rams, until the whole of the oil or other liquid product is expressed, when the exhausted materials are removed to make way for a fresh supply.

The *second* improvement in presses has relation to those hydraulic presses wherein the pressure is applied to the materials under treatment in drawers or boxes. The drawers are perforated at the sides, and each one has a block underneath of a size to fit the interior of the drawer next below it. The pressure is applied from below, and when the oil has been obtained, the drawers are lowered to their first position, and being slid out upon a frame raised for that purpose at the sides of the press-bars, are emptied by allowing the bottoms, which are hinged to the sides, to fall downwards, after which they are again charged and slid into their proper positions in the press for another operation. The process is much facilitated by having two sets of boxes, and using them successively.

2. When fatty matters are subjected to heat and pressure in cocoa-nut matting, they are found to be discoloured thereby, and this advantage is proposed to be got over by the use of matting composed of Brazilian grass or fibre of the aloe leaf. The Brazilian grass is cut into shreds and plaited, and the fibres of the aloe leaf are twisted together, and worked into matting, which may be advantageously used for other purposes than that mentioned.

3. The process of lime saponification is found to be much improved if air be excluded; with this view, therefore, the patentees conduct this process in closed vessels, and introduce steam, by which the air is expelled. The steam is admitted through pipes, coiled in the bottom of the vessel, and is thus made to serve the double purpose of heating the materials under operation, and of preserving them from contact with air.

4. It is found that distilled fatty acids do not contract much, or lose bulk in cooling; and there is therefore a difficulty in withdrawing candles made from such fatty acids from their moulds when composed of metal. The patentees propose, however, to use moulds made of glass, and they wick these moulds by means of the machine known as "Morgan's." The moulds are made from glass tubes, and the ends of the tubes are blown or drawn to the shape required by the particular kind of candle to be moulded, and in order to lessen the chances of accident, the moulds are set in or supported by flexible materials, such as India rubber.

5. The product of the process of lime saponification is capable of being readily bleached by the application of sulphurous acid gas. For this purpose the soap is directed to be reduced to powder, and the gas is forced to traverse it by the action of a suitable pump. For the sake of economy, the patentees employ the sulphurous acid gas, which results from the process of "hot acid saponification."

6. The stearine of cocoa-nut oil may be profitably employed in the manufacture of candles not requiring to be snuffed by using the same in an uncombined state with wicks, so plaited, that while burning, they may be capable of turning out of the flame. The wicks are preferred to be made of a rather

large size, and where two are used, they should be disposed so as to turn out of the flame in opposite directions.

7. With a view to cheapen and improve the manufacture of night-lights, the patentees propose; *first*, to size the paper of which the boxes or cases are composed, and to use thin instead of thick paper, and the sizing to be effected by immersion or with a brush; *second*, to dispense with the bottom card of the box or case where wick-sustainers are used, and to fold in the paper of which the sides of the case are composed, so as to form a bottom, using size to render it firm when necessary; *third*, to ornament the cases cheaply by printing in coloured ink on uncoloured paper; and *fourth*, where gelatine cases are employed, to strengthen them by the introduction of threads or fibres in the course of making.

8. The patentees describe two arrangements by which the cases of night-lights may be expeditiously and effectually filled without any waste of materials.

Claims.—1. The improvement in presses described.

2. The manufacture and application of matting, as described.

3. Excluding the air when saponifying and decomposing fatty and oily matters.

4. Operating on or treating saponified matters by sulphurous acid gas.

5. The moulding of candles made of distilled fatty acids in glass moulds, and the making of glass moulds and setting them in elastic materials.

6. The manufacture of candles by employing the stearine of cocoa-nut oil, combined with wicks which, in burning, turn out of the flame.

7. The means of improving and cheapening the manufacture of night-lights; also the combinations of machinery for filling several night-light cases or boxes.

François Marie Lanoa, of Paris. *For improvements in apparatus for holding and drawing off aërated liquors, and in machinery for filling vessels with aërated liquors.* Patent dated November 3, 1851.

1. The patentee describes an improved syphon, tap, or stopper for aërated liquor-bottles, in which a passage is opened for the escape of the fluid by pressing down, by means of a screwed cap, a valve in the centre of the stopper. A spring is coiled round the stem of this valve, to bring it back and close the passage when the pressure of the cap is removed; and suitable provision is made for the escape of air when the vessel is being filled, by the downward motion of the valve unclosing an aperture in the neck of the stopper.

2. For filling bottles, the patentee applies a modification of the arrangement just mentioned to vessels capable of containing a large quantity of aërated fluid, which he draws off into bottles.

Claims.—1. The mode of pressing the valve of the stopper by means of a cap or cover, and also the apparatus for allowing the air to escape from the vessel when filling.

2. The apparatus for filling vessels with aërated liquors.

Henry Hussey Vivian, of Singleton, Glamorgan. *For improvements in obtaining nickel and cobalt.* (A communication.) Patent dated November 4, 1851.

It is well known that all copper ores, foreign as well as British, contain a certain proportion of nickel and cobalt, or one of these metals, which as the ores are at present treated, goes entirely to waste. Now the object of the present invention is to separate the nickel and cobalt from the copper, and obtain them in the form of arsenurets in a marketable state. This object the patentee effects by availing himself of the affinity of copper for sulphur, and of nickel and cobalt for arsenic.

The process adopted is divided into two steps or branches. The first of these varies according to the nature of the ores or compounds of copper operated on, which may be divided into four classes. The first class comprises ores, slags, and other compounds containing copper and other metals, chiefly in an oxidised state. These the patentee treats by the addition of a sufficient quantity of arsenical pyrites to combine with the whole of the nickel and cobalt present, together with a portion of the copper, sufficient sulphur in the state of iron pyrites, or raw ore furnace metal, to combine with the remaining portion of copper, to form a regulus and coal to facilitate the reduction of the oxides. These several matters are melted together, tapped out of the furnace, and when the slag has been skimmed off, and the pigs are cool, the nickel and cobalt will be found to have combined with the arsenic to form an impure arsenical compound, which settles to the bottom of the pigs, and is removed for treatment by the second part of the process. If all the nickel and cobalt are not separated, the regulus may be melted again, and the melting repeated as often as may be found necessary. The quantities of arsenic and sulphur, which should never be used in their free state, will, of course, vary with the ores to be operated on. The following proportions, however, have been found to answer when treating oxides of copper produced by calcining regulus of

copper of 70 per cent., 8 cwt. arsenical pyrites, 12 cwt. raw ore furnace metal, of about 30 per cent. sulphur, and 2 cwt. of coal to every 20 cwt. of oxide.

The second class consists of copper ores and regulus containing small quantities of nickel and cobalt not in an oxidised state. These the patentee smelts in the usual manner until the product is a regulus of about 70 per cent. (commonly known as "white metal,") he then roasts the regulus as would be done for producing a metallic bottom, and on the completion of the first stage of the roasting process, and prior to melting for tapping, he adds 3 to 5 cwts. of arsenical pyrites for every 30 cwts. of regulus, then melts and runs the product into a sand bed. On lifting the pigs, when cold, a metallic bottom will be found under the first three or four, containing the principle portions of the nickel and cobalt in a concentrated state.

The third class comprehends copper ores, or regulus containing large quantities of nickel and cobalt, and not in an oxidised state. In such ores there is generally present a large quantity of arsenic, which is sufficient to combine with the nickel and cobalt, but if not, more arsenic will have to be added. This being the case, the patentee melts these ores or regulus in the usual way adopted for copper smelting; but instead of running the product into water to granulate, he casts it into pigs, and obtains a metallic bottom from the pigs, which will be found to contain nearly all the nickel and cobalt.

The fourth class consists of cupreous alloys. These the patentee treats by adding them to either one or other of the charges of the first three classes when about to be melted, and melting them therewith, or by granulating the alloys, adding arsenical pyrites, and proceeding as directed for ores of the first class.

The products of each of the above operations, or of all of them, are finally treated to obtain the arsenurets of cobalt and nickel in a marketable state, by reducing the impure arsenical compounds to powder, calcining and melting, with the addition of further quantities of arsenic, sulphur, and silica. These materials are introduced for the purpose of separating the nickel and cobalt, and converting the copper, lead, silver, antimony, and other metals to regulus, and the iron, of which there is always a certain quantity present, to slag. Of the arsenic, which is added in the state of arsenical pyrites, 10 cwts. are used to every 70 cwts. of materials to be treated; of the sulphur, in the state of sulphate of barytes, 8 cwts.; and of the silica, 12 cwts. These materials are melted together; the slag containing the iron is skimmed off, and the remaining product is then tapped into beds; and from the pigs thus formed, when cool, the regulus is removed, and treated in the usual way to obtain its copper and other metallic constituents, while the metallic bottom of the pigs containing the arsenurets of nickel of cobalt is separated from the regulus in a state of sufficient purity to be marketable. Should this not, however, be the case, they may be subjected to successive meltings and treatments, as just described, until sufficiently purified.

Thomas Greenwood, machinist, and James Warburton, worsted spinner, both of Leeds. *For improvements in machinery for drawing and combing wool, silk, flax, hemp, and tow.* Patent dated November 3, 1851.

Claims—1. A peculiar construction of drawing head for machinery for drawing wool, silk, hemp, and fibrous materials whereby two sets of fullers or gills may be made to act simultaneously on the sliver under operation; and also a mode of constructing drawing-rollers of such machinery whereby an intermittent motion is given to the sliver.

2. The filling of the combs of combing machinery by means of an oscillating or swinging filling head; the employment of retaining combs for holding the sliver whil it is being fed on to the travelling combs; the use of double travelling combs, or combs with teeth standing out in opposite directions, and at right angles to their line of motion; and the general arrangement and construction of parts described, constituting an improved combing-machine.

Robert Beswick, of Tunstall, Stafford, builder. *For certain improvements in the making or manufacturing bricks and tiles, or quarries, and in constructing ovens or kilns for burning or firing bricks, tiles, and quarries, and other articles of pottery and earthenware.* Patent dated November 4, 1851.

Claims.—1. A peculiar combination of materials [equal parts of pounded seggars, red marl, and fire marl,] for the making of bricks and tiles, or quarries; also, certain peculiarly shaped bricks, called "cap" and "solid angled" bricks, and the use of the same in constructing ovens or kilns for burning or firing bricks, tiles, and quarries, and other articles of pottery and earthenware.

2. A mode of constructing the walls of the flues and compartments of ovens or kilns for burning or firing bricks, tiles, quarries, and other articles of pottery and earthenware. [The bricks used are set on edge, and rabbeted at their edges, so as to prevent as much as possible the passage of

flame or heat between them, and the angles of the flues or compartments are formed of the "solid angled" bricks above mentioned, and "cap" and "bridging" bricks are also introduced to give additional strength. The cement used is composed of equal parts of unburnt sand, sand that has been used for placing "green ware" in the kilns, red marl, and fire marl mixed with water to a proper consistence.]

WEEKLY LIST OF NEW ENGLISH PATENTS.

Alexander Parkes, of Pembrey, Carmarthen, chemist, for improvements in obtaining and separating certain metals. May 1; six months.

Hugh Lee Pattinson, of Scot's House, near Newcastle-on-Tyne, manufacturing chemist, for improvements in smelting certain substances containing lead. May 1; six months.

John Moore, of Arthur's Town, Wexford, for improvements in nautical instruments applicable for ascertaining and indicating the true spherical course and distance between port and port. May 1; six months.

James Johnson, of Waterloo-place, Kingsland, Middlesex, hat manufacturer, for certain improvements in the manufacture of hats. May 1; six months.

Thomas Mosdell Smith, of Hammersmith, gentleman, for improvements in the manufacture of wax candles. May 1; six months.

William Wood, of Pontefract, York, carpet manufacturer, for improvements in the manufacture of carpets and other fabrics, and in apparatus or machinery connected therewith. May 1; six months.

Charles Thomas, of Bristol, soap manufacturer, for improvements in the manufacture of soap. May 1; six months.

Edward Gee, of Liverpool, merchant, for improvements in apparatus for roasting coffee and cocoa. May 1; six months.

Henry Bridson, of Bolton, Lancaster, bleacher, for improvements in machinery for stretching, drying, and finishing woven fabrics. May 1; six months.

Augustus Siebe, of Denmark-street, Soho, Middlesex, engineer, for improvements in machinery for manufacturing paper. (Being a communication.) May 1; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the manufacture of printing surfaces. (Being a communication.) May 1; six months.

Richard Archibald Brooman, of the firm of J. C. Robertson and Co., of Fleet-street, Middlesex, patent agent, for improvements in paddle-wheels. (Being a communication.) May 4; six months.

Richard Jordan Gatling, New York, for certain improvements in machinery for seeding grain. May 4; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
April 29	3234	Hargrave, Harrison and Co.	Wood-street, Cheapside	Parasol cane.
30	3235	W. I. H. Rodd and Co.	Little Newport-street	Filter tap.
May 1	3236	J. Graham and J. James	Birmingham	Carpet bag.
,,	3237	G. Fletcher and Co.	Wolverhampton	Portable bedstead
3	3238	C. Maschurts	Birmingham	Match box.
,,	3239	Morris and Son	Astwood Bank, near Redditch	Needle case.
,,	3240	A. Stuart	Edinburgh	Script type, to be called "The American mercantile script."
,,	3241	A. Stuart	Edinburgh	Script type, to be called "The American mercantile script."
5	3242	L. Glyde.	Hastings	Air-tight valve for beer engines.
,,	3243	M. Buck	Skeyton, Norfolk	Currant dressing machine.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

April 29	408	S. Foist	Birmingham	Tap and valve.

CONTENTS OF THIS NUMBER.

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No. 1501.] SATURDAY, MAY 15, 1852. [Price 3d., Stamped 4d.

Edited by J. C. Robertson, 166, Fleet-street.

CONGER'S TURBINE.

Fig. 1.

Fig. 4.

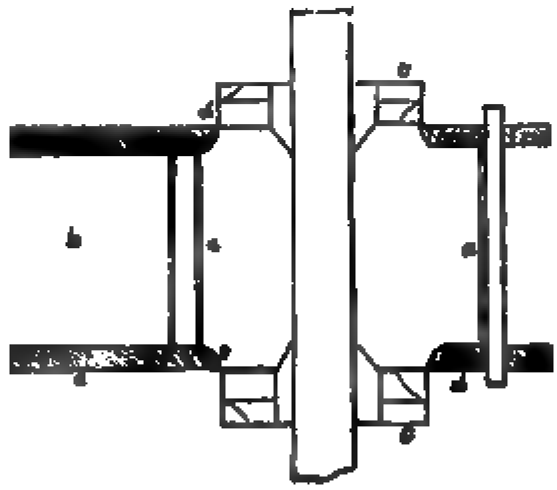

Fig. 5.

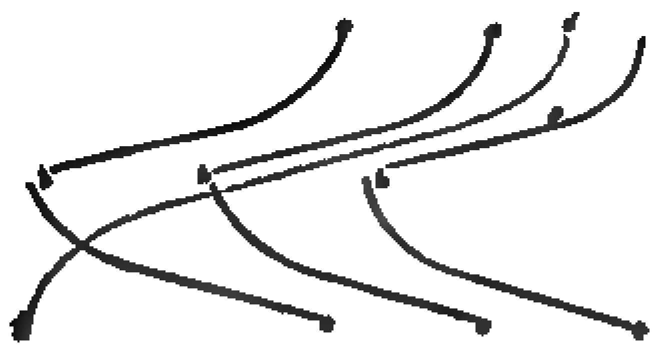

Fig. 2.

Fig. 3.

CONGER'S TURBINE.

The prefixed engravings represent an improved water-wheel of Mr. J. B. Conger, of Jackson, Tennessee. Fig. 1 is a perspective view of the wheel, with the guides, rim, and centre of a wheel 6½ feet diameter, having 16 stationary guides placed on the edge of a circular space in the floor directly over the wheel, into which they direct the water. Fig. 2 is a perspective view of the wheel, guide and scroll as applied to a saw-mill with a small fall of water. Fig. 3 is a vertical section of the same, and fig. 4 is a horizontal section of it. Fig. 5 is a diagram, showing the curve and position of the guides of the wheel, fig. 1. The accompanying description refers to the figures, particularizing the same by the letters of reference.

In fig. 1, *c* is the turbine wheel; it is precisely similar to the one above it, except in the guides which are placed in a reversed position, as shown in the diagram, fig. 5; S is the shaft of the wheel; it passes through the centre of the guides. A A is part of the floor of the pen-stock that surrounds the wheel, into which the water is admitted, and where it stands with its whole head above the wheel. The wheel, however, for convenience, may be placed more near the level of water, by having an air-tight vessel to conduct the water below the lower level, and this will not affect the operation of the wheel. This principle is well known in the United States, and has been practised for some twenty years, although it is spoken of in a recent French work, in describing a wheel, as being something new and a French invention.

In the diagram, *a b*, *a b*, *a b*, show the curve and position of the guides of the wheel, and *b c*, *b c*, *b c*, that of the buckets of the wheel. The curve of both guides and buckets is similar; from *a* to *e* (fig. 1) is part of a cycloid, *e* being the vertex and *a* the cusp; *c* and *b* are tangential to the vertex, *e* (small letters in the middle dark line, fig. 1). The top and bottom, and all the horizontal sections of the guides and buckets, are radial to the wheel. The dotted line, *d f*, in the diagram, shows the direction or path of a molecule of water in its passage through a guide, and a bucket of the wheel. Its downward velocity is equal throughout its whole descent from *d* to *f*. The water enters the turbine without shock, as nearly in the direction of its rotation as it is possible for it to do, and leaves it at *e*, in as near an opposite one, without velocity, except a downward motion, sufficient to give place to the succeeding water. With any other form of guides or buckets, it is not possible to make the water enter the turbine as near in the direction of its rotation, and to leave it in the opposite one, with as little velocity; for, if the bottom part, *b e*, has any curve at all, the direction of the influent and effluent water will form a greater angle with the plane of rotation. The loss of effect sustained by this indirect action of the water on the turbine, will be as the difference of the cosine of this angle and radius. The principle claim of Mr. Conger's patent is for the form of the guides and buckets. A wheel formed with the buckets or guides having the bottom part plain, is claimed to be an infringement of this patent. A more full description of this action of the water on this wheel was given in Nos. 50 and 51, vol. vi., *Scientific American*.

In the figures, 2, 3 and 4, *a a* is the scroll which gives the water a whirling motion in the direction of the wheel's motion; *b* is the shute which admits the water into the scroll; *c* are the turbine wheels, two on a shaft, only one of which can be seen in figs. 2 and 3, but the section, fig. 4 (although in a reversed position), shows the two wheels. *d d*, *d d*, are the ends of the scroll; it is made of 3 or 4 inch planks, confined together with iron rods. There is a circle cut out of the planks equal in size to the inside of the rim of the wheel, as shown at *c*, fig. 3, and at *e e*, fig. 4; S is the shaft. The area of the cross section of the shute, at *f*, should be equal to that of all the issues of both wheels. The principle of action is the same in these turbines as the one (fig. 1) on the vertical shaft; the curve and position of the buckets is also the same.—*Scientific American.*

NOTES ON SIR SAMUEL BENTHAM'S INTRODUCTION OF MACHINERY INTO THE ROYAL DOCKYARDS.

The late investigations relative to the block machinery at Portsmouth have brought to light some particulars that seem to call for notice. The invention of the slide-rest, for instance, which Mr. George Smart stated in evidence to have been devised by General Bentham, but which Professor Willis has informed us was engraved in the plates of the French *Encyclopedie* as early as 1772. It is believed that Bentham was not acquainted with the *Encyclopédie*, so that he might have re-invented that useful apparatus; evidently he was supposed to have been its originator by mechanical men at the end of the last and at the beginning of the present century. Mr. Smart is believed to have been the first private manufacturer who made use of Bentham's machinery, and he did so to a considerable extent.*

In Mr. Burr's evidence, he states that men at the wood-mills earned from 28*s*. to 30*s*. a week. He must have meant the few *skilled* workmen employed in finishing blocks, or in making those of which the number was so few that it would not have paid for the introduction of machinery. Burr himself stated that a man's wages at the rebating-machine amounted to no more than 12*s*. a week.

Dupin, in his "*Forces Navales*," eulogized Bentham for having, on his first interview with Brunel, declared that his (Brunel's) machine was better than his own. The compliment has, thoughtlessly, been hitherto accepted for him; indeed, he was wont thus to acknowledge superiority wherever it appeared: but, on reflection, there seems no ground for Dupin's assertion. No second person was present at that interview, which lasted perhaps an hour, or more. From what quarter had Dupin received the anecdote? No such circumstance was, during the course of many years, ever hinted at by Brunel in the writer's presence; nor was it by either Bentham, Goodrich, or Burr. Bentham had no acquaintance with Dupin; but that gentleman, when in England, had evidently intercourse with some of Brunel's friends, as also with many who were professed opponents of Bentham's plans. Those for Sheerness were misrepresented to him, and others stated as having had their origin in other quarters, yet Dupin, more than any other author, excepting Fincham, has given the best account of Bentham's dockyard improvements, and has not withheld the praise they merit.

Bentham has said, in his letter to the Admiralty, Feb. 7th, 1831, that he was accustomed, "when in office, to find objections made to, I may say, *all* my proposals of improvement;" and such opposition contributed in some considerable degree to his recommendation of Brunel for the introduction of block machinery. It had happened that a plan of Bentham's, for driving piles by steam power, in Portsmouth-yard, had just been defeated by the opposition of contractors, joined to dockyard prejudice in favour of *established practice*. The ground of opposition was, that his apparatus *did too much work!* During the enlargement of Portsmouth Dockyard, about the beginning of 1802, Parlby and Barchin being the contractors for building the sea-wall, pile-driving engines were very rude, clumsy, and ill-contrived: the ram or weight, now called the monkey, was raised by a common windlass by twelve, sixteen, or more men, as the case might be. About this time—summer or autumn, 1802—Bentham had a pile-driving apparatus put on board his steam dredging vessel, for the purpose of driving the piles of the dam: it answered most successfully; but this same steam dredging apparatus had so *awfully* (to use the term employed) reduced the expense of mud-dredging—that is, from 2*s*. 6*d*. per ton to about 2½*d*.—that it was feared a similar reduction would be effected in pile-driving. All voices were raised within and without the dockyard, exclaiming against General Bentham, for inventing machinery to supersede poor men's labour! The contractors likewise feared its introduction; some correspondence upon the question

* We think this matter still wants a little clearing up. We believe it will be found that Mr. Smart referred to one thing and Professor Willis to another. The former had in view the parallel guide, which is an appendage to the circular saw-bench, and which was, beyond all doubt, invented by Sir Samuel Bentham, being distinctly described in his patent of 1793; but what the Professor referred to was the sliding-rest, by which the tools in a turning lathe are guided in a direct line by a screw.—ED. M. M.

ensued between them and the officers: the contractors reported that the piles were driven *too fast*, and they would not be answerable for their standing;—the apparatus raised the ram *too fast*, &c., &c. The dredging vessel being required at another part of the yard, it was removed, and the antiquated way of raising the ram by the common windlass was again had recourse to. Had the contractors not objected to driving piles by steam power, Bentham intended to have attached an apparatus to his moveable steam engine then in use for pumping the dams, so that this engine would have been available both for pumping the dams and driving the piles. The contractors' foreman acknowledged that the piles were well driven, but justified the rejection of the apparatus on the ground that it would throw many people out of work. How widely different were the feelings as to machinery in 1802 from those in 1848, when Nasmyth's admirable machine was introduced! As to throwing poor people out of work, Bentham always provided employment for those whose labour was superseded by his machinery. It was not the working man who suffered, but the contractors, whose exorbitant profits were saved to the nation by his innovations in the wood-mills and metal-mills, &c., and so it would have been by driving piles by steam power.

Bentham's ideas as to the advantages derivable from a regular sequence of machines may be inferred from his having always spoken of his machinery for working in wood as a *system*. But to prove that even in Queen-square Place he had provided engines to perform, one after the other, all the operations requisite in the completion of a given article, some of his papers previously to the year 1795 have been looked over—few of them have been preserved; but there remains one that exhibits the sequence of operations he devised for making the felloes of wheels—those operations being numbered by himself as in the following transcript from his own notes, written down for his private use:

1.

"The felloes first sided by parallel saws.

2.

"Laid on a flat side of a wheel divided into the radii where spokes are to be.

3.

"Cut to their lengths by saw moving in direction to the (the word illegible), not minding where they join so that it be clear of spokes.

4.

"Joining of the felloes to be then effected, bringing one into the others not more than one-eighth of an inch.

5.

"The rim thus complete, turned on its inside and edge.

6.

"Holes bored for spokes by borer working upwards from the centre, and set to the dishing.

7.

"For the turning a side, lest the tool should take up the grain, a plane may be used. A plane of several strata, or else one advancing till a stop prevents its taking any more.

8.

"This plane may have beads, or any kind of moulding.

9.

"If it be required that the inside edge should be rounded off, or chamfered in any eccentric manner, a new centre for this purpose may be made to revolve at an equal distance round the centre of the wheel."

[The *form* in which the above was noted down would, doubtless, be found as convenient for mechanical contrivances as it is in literary composition. Jeremy Bentham had long used paper *ruled in columns*, when Samuel adopted the same practice on his return to England; these columns facilitated a first *sorting* of ideas. Thus, in the instance of arranging a sequence of machines for felloe making, that subject alone appeared in the chief column; in the other columns were set down ideas occurring at the moment, but that were not immediately relevant to the felloes, though they bore upon the manufacture of a complete wheel, or of parts connected with it. Some of the items contained in the secondary columns are as follows, the several columns being here distinguished from each other by a separating line.]

"For cutting the round tenon on the spoke for going into the felloe when

made, there may be in a case, fitted to the mandril of a turning lathe, so much only of the spoke as is to be turned away appearing out of the case; and the spoke laying in the case, in the direction with respect to the axis of the turning lathe, as the angle of the disking may require.

A groove may be cut in the inside of the felloes like a mortise, after they are fixed in the lathe. It would be better that they should not go through.

"One engine to cut from the outside, the different parts being applied successively to it.

"Tenons that do not go through to the inside of the felloe.

"Iron tires, two rows of them, one giving scarf to the other, and both to the felloes.

"Wheels pressed together by screws to each of the three parts embracing the felloes.

"An outside walking wheel to turn the chuck for the felloes; and when less force and more velocity is required, a handle put in the side of the same wheel admits of its being turned as a winch, the weight acting as a fly.*

"One lathe for roughing and finishing one side.

"One for the other side.

"One for mortising and boring.

"One for nave turning.

"One side of the felloe planed.

"Spokes fastened to the chuck and turned, then cut to their lengths.

"It is to no purpose that wheels are true if axletrees are not so in their length and direction.

"The ends being first turned true, may be put in great vices, which embrace the two ends, and keep them fast; while the middle part, being heated, is hammered or pressed into its proper shape, and the holes punched for the perch-bolt, and the fastenings to the wooden part of the axletree."

Bentham's inventions for working wood, though duly appreciated at the end of the last century, have not been so latterly, until very recently. Indeed, endeavours have been but too successfully made to conceal his improvements, and to appropriate many of them by other persons.—For instance, the Admiralty, in 1812, rejected Bentham's official proposals of machinery, amongst others, that for cutting *curved* timber, but a subsequent Board, at the instigation of a *private* person, have, at considerable expense, adopted his machine for the same purpose; but which competent judges say is inferior to the apparatus described in Bentham's specification of 1793. A working model of that saw-frame was made in the year 1849, by Mr. R. Prosser, of Birmingham, and by him contributed to the Exhibition there, together with an attendant to cut the pieces of timber called "futtocks" in ship-building, several hundreds of which were given away. The Exhibition of 1851 proved that in many quarters a disposition still continues to bring forward his inventions as those of others. On that occasion an energetic supporter of Bentham's claims paid much attention to the wood-working machinery exhibited, and applied by note to the executive committee for leave to make sketches in aid of memory to prepare an article on the subject. Mr. Digby Wyatt replied, that it would be necessary to obtain the consent of *all* the exhibitors! They amounted to some 14,000, so that, of course, the attempt was not made.

There were several machines in the Exhibition for sawing "curvilinear" wood. The same gentleman, on looking at the model of the one in Woolwich Dockyard, saw upon that model a small futtock which he felt certain had been sawn by Mr. Prosser's model of Bentham's machine, and said so. On this, some American gentleman, whose name could not be learnt, observed that he had no doubt that that advocate of Bentham's machinery had put it there. He replied that he had not done so, nor did he know who had; but he did know that hundreds had been cut by Mr. Prosser's model at Birmingham, and given away; but as the American seemed interested in the subject, an offer was made to exhibit Mr. Prosser's model at work, accompanied, at the same time,

* It must be borne in mind that Bentham's machines were intended for the employment of convicts, the more intelligent of them in tending machines, others in giving motion either by the weight of their bodies, or by muscular exertion. Arrangements of the same kind are applicable to machine-tools in small workshops.

with an observation that all the machines for working wood that were in the Exhibition were mere plagiarisms of General Bentham's inventions, as described in his specifications which were printed in the "Repertory," vol. v. (1796), and vol. x. (1799). The same gentleman farther proposed the nomination of three persons on each side, to whom the several machines should be exhibited in action, leaving it to their decision as to whom the merit of wood-working machinery belonged. To this the American would not consent, and he left the place.

The gentleman in question, in communicating the above details, added, "I am quite confident that to General Bentham we owe all our knowledge on working wood by machinery. I do not mean to say there have been no inventions in the same line, but I mean to assert that they are second inventions, and have no rights." He said that "he had investigated the subject with great care, and that, although the Americans have carried wood-working machinery much farther than we have, yet all their machinery is on the plan laid down by General Bentham's specifications."

M. S. B.

LACE-WASHING.—RENOVATING SOILED SILKS.

Among the machines of Bentham's invention which were made and put to work in Queen-square Place, was one for washing lace, designed for the employment of female convicts. It so well answered its intended purpose, as to merit introduction when any considerable quantity of lace has to be cleansed and dressed.

The objects aimed at in this contrivance were to save time and trouble to the laundress, to lessen the usual amount of wear and tear of so delicate an article on being washed, and, in regard to new lace, to retain the appearance it has on coming from the lace-pillow.

Bentham's machine consisted of a cylinder revolving horizontally in a water-tight trough; above the cylinder was a beater, made to rise and fall upon the cylinder. Both cylinder and beater were covered sufficiently with linen to give them the requisite softness, the exterior fold being of a fine texture. The lace to be washed was carefully rolled smooth, one fold over the other, upon the cylinder, then placed in the trough, which was then filled with the proper solution of soap. Motion was given by the foot to the machine, the cylinder turning round whilst it received strokes from the beater, and the operation was continued as long as requisite for beating out dirt from the lace. A second beating, in fresh soapsuds, was given when necessary; a rinsing in fair water was then given, and afterwards any desired colouring or stiffening mixture was, by the same beater, made to enter the lowest fold of lace. The cylinders were then taken out of the apparatus, and the lace dried upon them.

Where a boiling heat was desirable in the trough, this was provided for by making it of metal, and heating its contents by either fire or heaters under it.

The wear and tear of lace consequent on pulling it out and ironing it in the usual way was saved by this mode of cleansing the article; and where it was new, the pearl at the edge of the lace remained open as if fresh from the lace-pillow. In France, this appearance is given to lace when it is *lavé à neuf*, as it is called. In this mode the article, when washed, is spread on the circumference of a large, broad hoop, covered with baize, the laundress rests it on her knees, pins the footing of the lace straight, then inserts a lace-pin into every loop of the pearl at the other edge, extending the lace breadthwise at the same time. This tedious process is paid for by a charge of 10*d.* or 1*s.* a yard when the lace is about three inches broad,—a price which, of course, can only be afforded for costly fabrics; but the same appearance by Bentham's machine might be given to laces, and imitations of them, without the smallest extra cost.

When Bentham's services became appropriated to the public exclusively, he was considering the chemical question of washing blonde lace without destroying its gloss, discolouring it, or depriving it of the peculiar stiffness and general appearance of the article when new. This is still a desideratum, for blonde lace has always been a costly item in a lady's dress; yet, as it is particularly becoming, it is much to be wished its use could be extended to persons of moderate means by introducing easy means of washing it. The requisite inquiry would be, what

matter could be used to extract dirt without discolouring or otherwise injuring the texture and appearance of the silk itself? Bentham's machine would secure a preservation of the *form* of blonde lace.

A very analogous subject is the cleansing of soiled silks, as, when cleaned or dyed in the usual way, they rarely retain their original appearance. French silk-dyers, of a very humble class, study chemistry, and thereby excel the generality of Englishmen of the same calling; but superior chemical science would be requisite for perfecting the art of the silk-dyer; and probably some mechanical invention might enable woven fabrics of silk to be wetted without cockling. Small articles of this material have, indeed, been washed so as when cleaned to look like new, by not disturbing the disposition of either warp or weft. This was effected by spreading the article, when dry, upon a dry, polished, marble slab: cleansing liquids were then applied with a sponge, rubbing the fabric always in such manner as not to disturb its component warp and weft: air was thus excluded from underneath the silk, which adhered in its pristine form to the slab; the silk was left untouched till perfectly dry, then carefully raised, beginning at one end of the piece.

From petty results like this a hint is often taken which leads to practicable inventions of a useful nature.

M. S. B.

THE PATENT LAW AMENDMENT BILL.

The Patent Law Amendment Bill,—or, as it might more truly be styled, the Bill for the *Discouragement of Inventions and Improvements*,—has found its way from the House of Lords to the House of Commons; in which last it now loiters in a somewhat equivocal position—regarded with cold disdain by the law-officers of the Crown, only doubtingly patronized by the Board of Trade, distrusted by the judicious and discerning, and yet taken earnestly in hand by no one capable of a statesmanlike comprehension of the great national interests which it involves. The probability of its passing this session, in any shape, does not seem much; and but for the shattered state of parties at the present time which offers great facilities for the passage of crude and ill-digested measures, would be none at all. The Bill is still open to most of the objections which were urged against it in our pages, and elsewhere, last year. The preliminary examination clauses, so palpably fraught with hardship to the inventor, without any promise of countervailing advantage to the public, and so irresistibly suggestive of place-making and jobbing still stare us in the face. So also does the provision for excluding the Colonies from the operation of the Patent Laws—a provision defensible on no other ground than a suicidal predetermination to abolish them ultimately throughout the whole of the British empire. The scheme of requiring of an inventor to show that his invention is not only new in his own country alone, but new throughout the whole habitable globe—so ably commented upon in a recent Number by our correspondent, Dr. Normandy (see ante p. 285), is there too in all its unmitigated absurdity. From first to last,—in short, the interests of the inventor, and (rightly understood) of the public, are sacrificed to the innovating rage of a set of state tinkers as void of knowledge as of wisdom. Even in the hostile sense in which the bill is conceived, it is one of the most miserable pieces of legislation ever concocted; incongruous, contradictory, impracticable. *It could not work;* and if passed, would have to be repealed in a season or two after. The technical effects of the Bill have been exceedingly well exposed in a paper of "Observation," by Mr. William Carpmael; with a few extracts from which we shall for the present conclude:

> The first object of this Bill is to create certain Commissioners, who, together with the Lords of the Treasury, are to have the power to appoint numerous officers at such salaries as the Commissioners of the Treasury may see fit, and the present officers are to be allowed compensation. In the following observations only parts of the injury which the Bill would inflict on inventors and the public are noticed.
>
> It is scarcely possible to conceive a more simple process than that which now prevails in obtaining grants of Patents for inventions, and is, in fact, what has resulted from carrying out the recommendations of the

Committee on the Signet and Privy Seal Offices, reported January 1849; and all that is required, in order to make these matters perfectly satisfactory to inventors and the public, is, that the Government should reduce the fees, and which they can do without an Act of Parliament.

According to the present practice the inventor petitions for letters patent, and prepares a description of the nature of his invention; this application is referred to one of the Law-officers of the Crown, who reports thereon and sends a Warrant for the signature of the Queen, which, being countersigned by the Secretary of State and sealed by the Lord Privy Seal, goes to the Lord Chancellor, and the patent is completed. The mode proposed by the Bill to replace this simple practice, makes the matter the most complex and cumbersome that can possibly be conceived; this will be evident on comparing the number of documents which are required to be prepared under the old and new plans.

DOCUMENTS

Now prepared in obtaining Letters Patent.

1st. Petition, declaration, and a description of the invention. These are prepared by the petitioner.

2nd. Reference of the petition to Law-officer to Report and draw Warrant.

3rd. Law-officer, after giving notice to parties having caveats, issues his Report, which is accompanied by—

4th. A Warrant, which is signed by Her Majesty and sealed by the Lord Privy Seal.

5th. The Patent, which is made out from the Warrant and sealed by the Lord-chancellor.

N B.—Should there be any opposition, the Law-officer calls all parties before him and hears them separately, and at once decides the question.

DOCUMENTS

Which will hereafter have to be prepared in obtaining Letters Patent, if the Bill passes.

1st. Petition, declaration, and a description of the invention. These will be prepared by the petitioner.

2nd. Certificate by the proper officers of having received and recorded the above documents (Clause VII).

3rd. Reference to Law-officer by the Commissioners (Clause VIII).

4th. Reference from Law-officer to an Examiner (Clause IX).

5th. Certificate of Examiner that the provisional specification describes the invention (Clause IX).

6th. Approval, or allowance, by the Law-officer, of the Examiner's certificate, which, with the certificate, are to be filed with the Commissioners; and the provisional protection is to be advertised by the Commissioners (Clause XII).

7th. Notice by petitioner to Commissioners that he wishes his Patent to proceed, on which the Commissioners are again to advertise, when parties opposing may come in (Clause XIII).

8th. Reference to an Examiner, by Law-officer, of the petitioner's description of invention and the papers of parties opposing the grant (Clause XIV).

9th. Examiner's Report to such Law-officer (Clause XIV).

10th. Warrant prepared by Law-officer on receiving Report of Examiner, and such Warrant is to be sealed with Commissioners' Seal (Clause (XVI).*

11th. Patent prepared from the Warrant by the Commissioners, and sealed by the Lord Chancellor (Clause XIX).†

N.B.—I have not ventured to predict what will be the course pursued when a Patent is opposed, but that which is proposed by the Bill is open to very serious objections.

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* It is suggested, that according to the present Statute law, and which remains unaltered by the Bill, the Warrant would still have to be signed by Her Majesty, countersigned by the Secretary of State, and sealed by the Lord Privy Seal.

† The Author might have added at least two

At the present time no person can get protection granted to him in regard to any matter of invention, without an opportunity being offered to others to come in and be heard by the Law-officers of the Crown, who, at the very outset, and at a very small cost, decide whether the petitioning party is entitled to a grant of protection. By the Bill now before Parliament (Clauses IX. and X.) it is proposed, and this without any complaint against the present practice, so far as regards early investigation, to reverse this state of things, *and to grant provisional protection for six months, as a matter of course*, upon a petitioner depositing a description of an invention with the Commissioners. Now it is often found that the party first petitioning for a patent, on investigation by the Law-officers, is ascertained not to be the proper party to whom a grant should be made; and this occurs, notwithstanding it is known that the question is at the first step liable to be investigated. What, then, may be expected to happen when no inquiry is to be made? That great wrong will grow out of this, should it pass into a law, no one acquainted with these matters can doubt. Very many cases could be cited, but I will content myself with one:—A Mr. Brown had invented some very important improvements in capstans and windlasses, and having two workmen in his employ whom he considered deserving of confidence, he directed them to make models of the invention; shortly afterwards the workmen petitioned for a patent. Mr. Brown was heard in opposition, and the Law-officer refused a grant to the workmen, being satisfied that Mr. Brown was the inventor, and upon Mr. Brown petitioning for letters patent, they were granted to him. Mr. Brown had subsequently to proceed against a party for infringing his patent, and one of the workmen was put into the witness-box by the defendant, in the hope of proving that he and his fellow-workmen, and not Mr. Brown, were the inventors. The Judge and Jury were satisfied, however, that Mr. Brown was the inventor, and the patent was sustained.* If the law had then been as it is now proposed it should be, the workmen would have got immediate protection for six months, and Mr. Brown would have had no remedy, nor could he have forced the workmen to an investigation before the Law-officer of the Crown; on the contrary, they would have stood before the public with a certificate from the Examiner, giving them six months' provisional protection, notwithstanding they were wrong-doers. I am aware it is proposed (Clause XI.), that if any protection should be obtained in fraud of the first and true inventor, he is not to be injured, provided he obtains his letters patent before the expiration of the provisional protection given to the wrong-doer; but this, it is suggested, comes to nothing, seeing that there is no possible means by which the true inventor can get a grant within such period.

According to the present practice, the petitioner prepares a description of the nature of the invention, and if there be any other party or parties who think the invention may be like what they may have invented, they may come in and be heard by the Law-officer of the Crown, who, as before stated, at the very outset decides between the parties, and if the Law-officer have any difficulty, he can call in the aid of a person, practically informed, to assist him; but this does not occur in one case out of a hundred. It is now proposed (Clause III.) that officers, called Examiners, shall be appointed, who shall ascertain and report to the Law-officer the facts of the case; or, in other words, it is proposed to provide the Law-officers of the Crown with offices identical in character with what Masters in Chancery now are in regard to the Judges in Chancery, so that that class of officers which is now to be discontinued in respect to the Court of Chancery is by this Bill to be created in regard to the Law-officers of the Crown, and this is not in consequence of any statement on the part of the Law-officers that they are not able to ascertain the facts for themselves, but the proposition comes from parties who, knowing little of the real requirements, consider that the Law-officers ought to feel the necessity for such aid. These Examiners are also to possess that pre-eminent degree of knowledge as to be able, on the instant, to determine in each case on the *novelty* of the invention (Clause XIV.), and yet, strange to say, the patent granted on that report is to be on the usual conditions, viz., that if the invention is not new the patent is to be void. It may be desirable here to call attention to the before-mentioned Report, made January, 1849, which, in regard to the Law-officers, says, "With these objects in view, it has not appeared to us that any better course can be devised than a reference to the Attorney or Solicitor-General to inquire into the merits of the circumstances set forth in the Petition and Report thereon to the Crown. The inquiry would appear for the most part to involve considerations rather of a legal than a scientific nature. But should questions arise on an opposed Petition, where

more documents as essential: namely, the advertisement of the Provisional Protection (Clause XII.), and the advertisement of the Intention to Proceed Clause XIII.)—Ed. M. M.

* *Brown* v. *Wigram*. Court of Exchequer.

a more than ordinary familiarity with scientific subjects might seem requisite for the due comprehension of the matter under investigation, the Attorney or Solicitor-General would always have the power which they now possess and exercise of calling in some man of practical science unconnected with the parties before him, and unprejudiced in the matter in dispute, to aid him in coming to a just decision."

Illness or death may prevent a petitioner getting his patent sealed within six months (Clause XXI.), and such may be the case in some instances where the petitioner is perseveringly opposed, and which, by reason of the zigzag course through which it is proposed a patent should pass, may readily be accomplished by so conducting an opposition as to throw the petitioner over the time allowed, particularly if he should have availed himself of any considerable portion of the time of provisional protection. If this becomes the law, it will lead to a constant effort on the part of opponents to delay the sealing of patents.* There is no commensurate advantage gained by giving parties protection from the date of application, seeing that a patent can now be sealed in about three weeks, even when opposed, and in less time when not opposed; and there has, I believe, never been known an instance of a petitioner being injured by his invention getting into public use between the day of petitioning and the day of sealing his patent, and it is in attempting to cure this imaginary defect of the present law which induces the proposed change, and which, in place of doing good, is fraught with great evil.

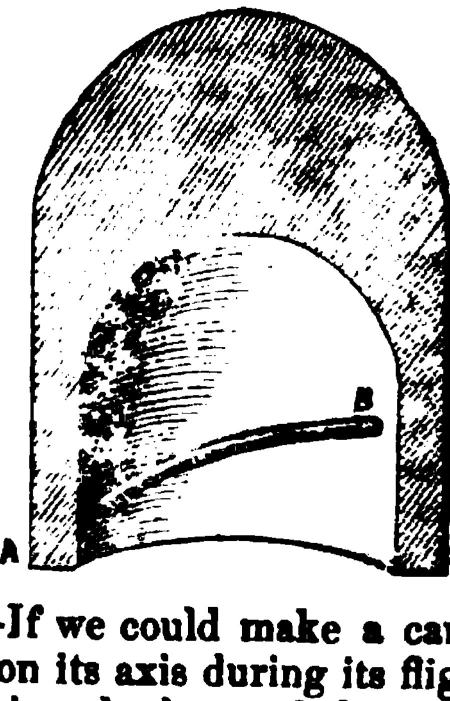
At present the petitioner for a patent deposits with the Law-officer a provisional or outline specification. In this document two or more supposed improvements in a manufacture are often to be found, and it occasionally happens that the patentee is unable to specify one or more of them from not having, from various causes, been able to carry them into practice during the time allowed. In such cases the law-officer will strike out such parts, which is a highly important privilege, seeing that, were such parts allowed to remain, other parties obtaining a copy of the provisional specification would be informed of the general principles of the uncompleted improvements. This would be very unfair to the inventor, as it would deprive him of all power to secure them by a subsequent patent. In other cases, the patentee finds out that some of the supposed improvements are not new or do not succeed in practice, and, therefore, he wishes to have them struck out from his provisional specification; otherwise his provisional specification would be found to be larger than the invention specified. In all which cases the law-officer will, upon application, strike out such parts. Now, according to the Bill, the provisional specification *can never be altered after* the examiner at the outset gives his certificate, so that there will often be a variance between the provisional and the actual specification. If this Bill should pass into a law, we shall have in the provisional specification to a patent, two, three, or more improvements, and in the subsequent specification a much less quantity of invention, described. What will be the effect of this in a court of law it is difficult to say, but it has been held that a patent is granted for the whole set forth in the original application, and, if it fail in one part, the patent is bad. (*Brunton* v. *Hawks*; *Morgan* v. *Seaward*.)

* * * *

There are other clauses in the Bill which direct the progress of a patent, and the stamp and fees to be paid thereon, which are at variance with previous Acts, and yet those previous Acts are not mentioned or repealed. The necessary result of this will be doubts of construction as to what should be done in particular cases; and much litigation to get at what is really the law.

* Since the above observations were written, this clause has been altered; and now, should there be opposition, the Lord Chancellor may seal the patent, and the same is to be valid, though it be after the six months of provisional protection. This alteration opens the question of time in such a manner that the greatest possible frauds may be committed against the public.

ROTATING CANNON SHOT.



Sir,—If we could make a cannon ball revolve on its axis during its flight without altering the bore of the gun from a true cylindrical form, it appears that one of the chief objections to the boring of rifle cannon would be obviated.

It occurs to me that this may be effected if the mode of construction represented in the annexed sketch were adopted. Within the chamber, at the rear of the ball, let A B be an iron tube extending round the half circumference of the chamber in a semicircle, and let there be a similar tube on the opposite side of the chamber (of which the figure is only a section). Now if this tube be filled with "rocket mixture," and a fuse fastened at the open end A, the composition will be fired when the ball commences its flight. The action of this internal rocket (with its opposite corresponding tube) would suffice to turn the ball upon its longer axis, and would give to it the same kind of rotation which would otherwise require a grooved bore. Perhaps this has been tried before; never mind, so were conical balls themselves for twenty years before they were approved of, and I cannot think that a suggestion is less valuable because it is resuscitated at a time when public attention is directed to the subject of which it forms a part.

Yours, &c.,
JOHN MCGREGOR.

Temple, April 13, 1852.

BELGIAN SAFETY-LAMP.

The accompanying diagram represents a section of M. Eloin's lamp, as manufactured by Messrs. Thornton and Sons, of Birmingham. The cylinder B, above the flame, is closed, and air is admitted only below the flame through a narrow breadth of gauze, C. A cap D, on the principle of the solar lamp, causes the admitted air to be brought into actual contact with the flame, and thus producing perfect combustion, giving a slight equal to at least five or six ordinary Davy Lamps, and one which the collier would prefer to any candle. There is no wire gauze to be injured, the light being radiated through a thick short cylinder of glass, A; and it has been found in practice that this glass is perfectly secure. It is bound top and bottom by a strong brass ring, and should it even crack, either by explosion or accident, the pieces would be still held together, and heating the gauze to redness is entirely prevented. The air which enters through the narrow breadth of gauze *below the flame* being only as much as is necessary to support the flame of the wick, and the combustion being perfect, that portion of the cylinder above must always be filled with the products of combustion, and never with an explosive atmosphere, which is clearly shown by the lamp being extinguished whenever the general upward current is reversed. So confident is M. Eloin of the action of the lamp in this respect, from his experience in the Belgian mines, that he has placed a very coarse wire gauze over the top of the lamp, simply for the purpose of preventing particles of dirt or coal dust from entering, but wide enough to admit flame, if any could be supported in the cylinder. A conical brass shade E, slides upon the rods surrounding the glass cylinder, which can thus, if necessary, be raised to the top, and form a reflector, to throw the light downwards, when required, which we suggest would be much more effective, if silvered or even tinned on the inner surface. From the scientific perfection attained in these lamps, and their exceedingly low price, there is now placed within the reach of every coal-owner the means of placing the collier in perfect safety from explosions; and with proper attention to the ventilation, we have no doubt that, when brought into general use, these dreadful calamities will be few and far between.—*Mining Journal.*

LALANNE'S GLASS SLIDE-RULE.

The peculiarity of this new slide-rule consists less in the substitution of glass for the usual ivory, bone, or wood, and in its consequent extraordinary cheapness, than in the introduction of sundry improvements by which, without any increase in the size of the instrument, its range of practical

utility is vastly extended. First, the absolute number of scales is much greater than usual; and, second, there appears (for the first time) upon the face of the slide itself, a number of constant multipliers or "gauge points," as they are called, which will be found of the greatest practical value. The instrument is accompanied with a short Treatise by the Rev. William Elliott,* in which the author not only gives a full explanation of the system of its construction and the manner of using it, illustrated by numerous examples, but a very complete account "of the theory of the sliding rule," in the *general*, which last portion is, of course, as applicable to other rules as to this of M. Lalanne. The book is, on both accounts, well deserving of perusal; we know, indeed, of no treatise in the English language to which a workman may have recourse with so much confidence as this for scientific help, which is essential to a thorough understanding of the uses of the slide-rule of every variety; for, after all, as Professor De Morgan has well observed, "the sliding-rule will *not teach the method of working any question*, but will only afford aid in computation, in multiplication and division to *any one;* in higher rules to those who understand their principles."

THE WOOLLEN MANUFACTURE.

Worsted derives its name from a village in Norfolk where these goods were first produced, in the reign of Edward the Third, at about the middle of the fourteenth century. Norfolk continued for four centuries to be the chief seat of the trade, which was protected by various legislative enactments, and enjoyed the active patronage of Queen Elizabeth, amongst other sovereigns. During the eighteenth century the trade appears to have gradually spread itself over England, but to have located itself particularly in the West Riding of Yorkshire. It received its first great impulse by the introduction in 1790 of the spinning machinery, which was then revolutionising the sister manufacture of cotton. The erection of the first factory in Bradford, in 1793, was accompanied, as usual, by loud predictions of ruin to the trade; but so far are these predictions from having been verified, that the trade has now entirely passed from Norfolk, which did *not*, to Yorkshire, which did, adopt the new machinery. In 1825, power-looms, again, not without riot and alarms, began to be used in this trade, and in 1830, great improvements in the modes of dyeing and finishing were introduced at Bradford. In 1836, Alpaca, which it is hardly necessary to say is the wool of an animal of the Llama tribe of Peru, was introduced, and very nearly at the same time Mohair, or goats' wool, from Angora in Asia Minor. The last improvement which this manufacture has received, is the recent one of machinery for wool-combing. The most remarkable result of these successive improvements, is the very rapid increase of population; in Bradford, from 16,000 in 1811, it reached in 1831, 43,500; in 1841, 66,700; and in 1851, 103,800;—being an increase during that period of 682 per cent. against 98 per cent. as that of the whole kingdom. According to the last returns of the Factory Inspectors, the number of persons employed in this trade is 79,800, of which Yorkshire employs 65 260; added to which there are at least an equal number employed out of the factories, and therefore not included in those returns.

It is curious to observe that although between 1840 and 1850 the increase in the persons employed has been 152 per cent. that of the power used has been 79 per cent. The main causes of this are—first, that a large quantity of cotton and silk warps are now used for these fabrics, which are included under the cotton and silk returns; and, secondly, the adoption of improved boilers and engines, and of finer lubricating substances, by which the same nominal horse power is made to turn one-third more spindles, and at a higher velocity.—*Lecture by Mr. Forbes, Soc. of Arts.*

SOLID COAL-GAS.

"It would be pronounced," says Liebig, "one of the greatest discoveries of the age, if any one could succeed in condensing coal-gas into a white, dry, solid, odourless substance, portable, and capable of being placed upon a candlestick or burned in a lamp." This greatest of discoveries has actually been made. A mineral oil flows out of coal in Derbyshire, which is obviously produced by a slow process of distillation from the coal; it consists, as fuel, of solid paraffine dissolved in a liquid oil. A consideration of the conditions under which this natural

* "A Description of the Slide-Rule, with Particular Directions for the Use of the Glass Slide-Rule, Invented by M. Leon Lalanne. By the Rev. W. Elliott, M.A., Queen's College, Cambridge." 12mo. pp. 48. Elliott and Co., 56, Strand.

product is formed has led Mr. James Young, of Manchester, to the discovery of a method (which he has patented) of readily obtaining the paraffine in any quantities required, and at a cheap rate (compared with ordinary candles), from ordinary coal gas.

AIR RENDERED VISIBLE.

The Paris correspondent of the *Washington Republic* says:—

"At the last sitting of the Academy of Sciences, a very remarkable paper was read. It was presented by a well-known engineer, M. Andraud, who has made many public experiments on compressed air as a substitute for steam on railways. I gave you a *resumé* of the contents of this paper. It is entitled Æroscopie, or the visibility of the Molecules of the Air. Some of the deductions made, in a medicinal point of view, are in the highest degree curious. M. Andraud proves that, by a very simple contrivance, the air is rendered visible. By taking a piece of card, coloured black, and piercing it with a fine needle, this interesting fact is established. If we look through this hole at the sky on a fine day, or at a strong lamp having a ground glass shade, we see a number of transparent globes moving in the midst of confused nebulosities. These little globes, some of which are more transparent than others, are molecules of air. Some of them are surrounded with a kind of halo. These latter, says M. Andraud, are the elements of azole. After continuing the observation for some time, we shall see small points detach themselves and disappear in falling; these, says M. Andraud, are atoms of carbon. This phenomena of vision, it is essential to remark, passes within the eye itself: the molecules of air observed, are those which float in the liquid, which occupies the interior part of that organ. According to the author of this paper, the discovery is not interesting merely as a phenomenon, but may be applied to important purposes in medicine. He says:—'The physician will one day make use of the æroscope as an important means of diagnosis. Vertigo, giddiness, which are the forerunners of apoplexy, will be announced by the perturbation in the molecules. Fever always exists when the molecules, under the action of a magnetic current circulate on a vertical ground—sometimes in one sense, and sometimes in another; and, when this movement of gyration becomes more precipitate, the patient experiences the singular sensation of turning, as it were, upon a wheel of Ixion. I cannot resist remarking that, in most cases of opthalmia, a prompt cure might be effected by securing the eye completely against contact with the external air; for inflammation (which is only an oxydation) is kept up by the too abundant absorption of our molecules of air, which is effected by the pores of the prunella; this absorption being prevented, the malady must cease. This observation may apply to all cases of inflammation, for the air is an element of which the affected part must be deprived."

AMERICAN RIFLEMEN.

Europeans are not acquainted with what has been done in America—the greatest country for rifle shooting in the world. The best work on the subject is that of "the American Rifle," by our friend Mr. John R. Chapman, of Oneida Lake, N.Y. In Mr. Chapman's work, there are samples of American target shooting at 220 yards, the target being 20 inches diameter. In one sample, 10 shots can be covered with a man's hat around the bull's eye. Our crack rifle shooters employ telescopes on their rifles. Edwin Wesson, who is now mouldering in the dust, used to make fine rifles. We understand that since his death, the factory at Hartford, Conn., has broken down. Mr. James, of Utica, N. Y., makes splendid rifles, and there are a number of excellent rifle makers among us. We would call attention to Mr. Chapman's work. He says that a first-rate American rifle, with a telescope, will, in still time, throw all its shots, at 220 yards distance, into a circle of 1½ inches diameter, and at 440 yards into a circle of 8 inches diameter. No European shooting, we believe, can compare with this.* He advises the arming of select riflemen with telescopic rifles; a thousand of them would destroy an invading army of 30,000 men armed with muskets before they could advance very far into the interior.—*Scientific American.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MAY 13, 1852.

THEODORE KOSMANN, of Cranbourne-street. *For improvements in brooches and other dress fastenings.* Patent dated November 4, 1851.

The patentee describes several modes of

* Yes, it can and may be seen from the following extract of a letter from an officer serving in the Caffre War, published in the *Times* of May 1: —"I have seen, I suppose, some 100,000 rounds fired from one firelock, and have seen the effect of Caffre fire to nearly the same amount; and I say that, first, an old flint musket, in the hands of a Caffre, who puts in about six drachms of powder, will kill a man at 800 yards; a regulation firelock, charged with four drachms and a half (the soldier spills half), ditto at 550; common rifle, charged with two and a half drachms ball, conical, hollowed out at the base, 1,200."

fastening dress ornaments, the principal one of which consists in the use of a supplementary hook, attached by a chain or spring to the article to be secured, and inserted into the dress when the pin of the brooch or other fastening has been introduced, and at as great a distance from it as the length of the chain will admit of; or the hook is attached to the head of a shawl pin, and secured by drawing the pin backwards after it has been introduced to its full length.

Claim.—The adaptation to all kinds of dress ornaments of the several modes described of securing and fastening the said articles.

Jules François Dorey, of Havre, gentleman. *For improvements in illuminating the dials of clocks, and other instruments in which dials are employed.* Patent dated November 4, 1851.

The method of illuminating clock and other dials, which forms the subject of the present patent, consists in the combined use of a transparent dial and semi-transparent pointer or pointers, the figures or letters on the dial being also made semi-transparent. A chamber, formed of or lined with black cloth, is placed immediately behind the dial, and the gas, or other lights by which the illuminating effect is produced, are placed at a lower level than the centre of the dial or the eye of an observer, and the light is diffused equally over its entire surface by means of reflectors. In order to prevent any portion of the light being intercepted by the axis of the pointer or index hand, a strip of black chenille is wound round it spirally, and a series of shades are placed along the sides and top of the dark chamber to prevent the light being obstructed in its passage to the dial. The index-hands may be either placed outside the dial and protected by a glass, or they may be attached to their axis inside the dial, the transparent materials of which the dial is composed permitting them to be seen equally well in both cases. The effect of the arrangements, above described, in daylight and by dark, is that the hands and figures, or letters, alone appear transparent, the black cloth chamber behind the dial forming a dark ground, and serving to augment the effect of the illumination of the hands and figures.

Claim.—The application of a transparent dial having semi-transparent figures, letters, graduations, or marks, in combination with a semi-transparent hand or index, or semi-transparent hand or indices.

Joseph Robinson, of the Ebbw Vale Iron Company; Charles May, of Great George-street, Westminster, engineer; and William Thomas Doyne, of Euston-square Station, civil engineer. *For improvements in the permanent way of railways.* Patent dated November 4, 1851.

This invention consists in so constructing the permanent ways of railways as to obtain for the rails continuous bearings or supports by the under-sides of the rails resting on longitudinal plates of wrought iron.

The drawings show several methods of combining rails with angle iron bearings to obtain this result. The rails are of various forms, but the same peculiarity of construction is involved in all the combinations of rails and bearings shown. In the case of single headed rails, the bearings are placed on each side of the rail, which they support between them with its lower edge resting on one or both of the bearings, and bolts are passed through the rail and bearings to connect them to each other. When bridge rails are used, the bearings are still of an angular shape, and are so disposed that one flange of each of the bearings shall enter the hollow of the rail, while the rail is supported by its lower edges resting on the surface of the bearings. The bearings are in all cases placed so as to break joint with each other, and with the rail which they support.

Claim.—The mode described of constructing the permanent ways of railways, by combining with the rails bearings in the form of wrought iron plates offering longitudinal supports.

Henry Vigurs, of Camden-town, engineer. *For improvements in buffers, grease-boxes, axle-boxes, and springs; and in appendages to railway-engines and carriages.* Patent dated November 4, 1851.

Claims.—1. The employment of a coiled spring applied to railway buffers in a peculiar manner described.

2. The general internal arrangement described of the grease chamber and passages (of grease-boxes and axle-boxes). Also, the general arrangement, combination, and adaptation of parts described for regulating, filtering, and supplying grease to the axle through openings in or at the side of the bearing brass. Also, a mode of constructing the covers of grease-boxes with a separate hinge. Also, the construction of the bearing brasses with two wearing surfaces. Also, the construction of bearing brasses to slide into the axle-boxes from the front. And, the application of a metal washer sliding vertically, either internally or externally, at the back of the axle-box to prevent the escape of grease therefrom.

3. The construction of springs generally, composed of several wires or rods of steel, brass, or other suitable metal, either with or without a central rod or core, twisted or stranded as a rope, and welded or sol-

dered together at the ends, and bent up into a spiral form. Also, the construction of springs of two or more plates or bars of steel, brass, or other suitable metal, laid together, and welded or soldered at the ends, and bent up into a spiral form.

4. The insertion into the bearing surfaces of break-blocks of plugs of wood harder than that of which the block itself is composed, or of plugs of metal.

5. An arrangement of sanding apparatus applicable to railway engines and carriages.

ALEXANDER DOULL, of Greenwich, Kent, civil engineer. *For certain improvements in railway construction.* Patent dated November 6, 1851.

Specification.

Firstly. My invention consists in forming the cast-iron chair commonly used in the construction of railways in the manner represented in plan and elevation, fig. 1.

Fig. 6.

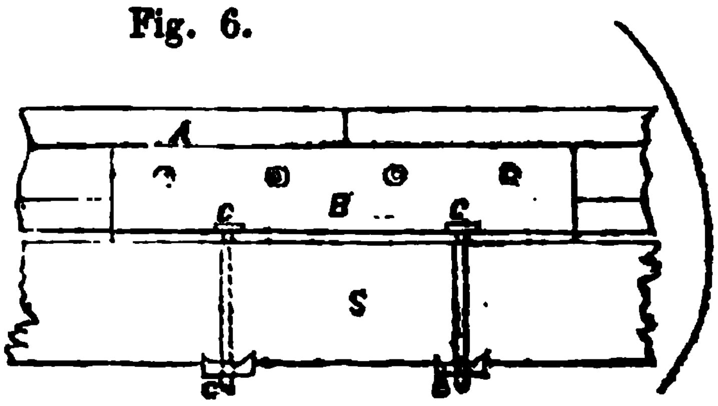


Fig. 3.

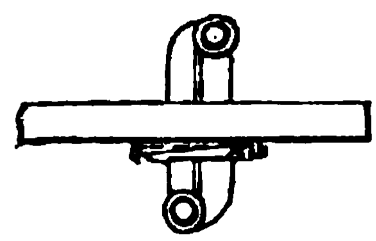


Fig. 1.

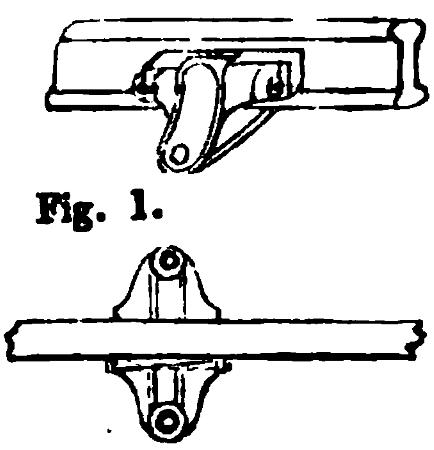


Fig 2.

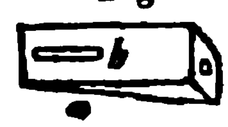


Fig. 4a.

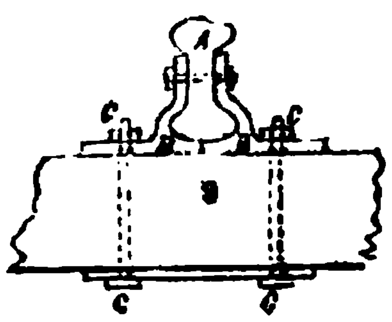


Fig. 5.

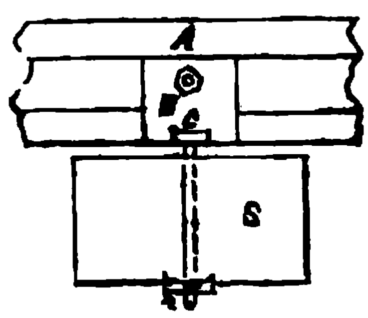


Fig. 4.

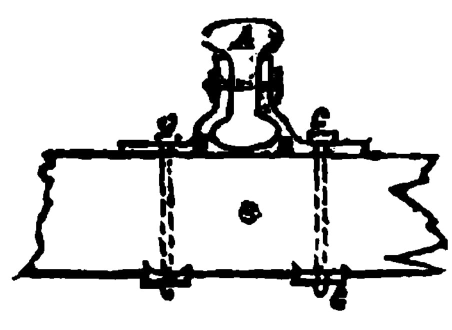


Fig. 16.

Fig. 15.

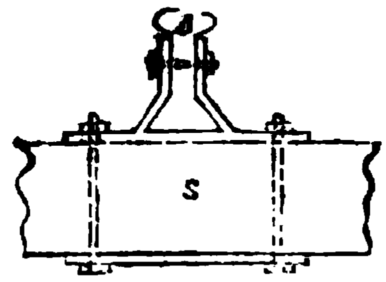
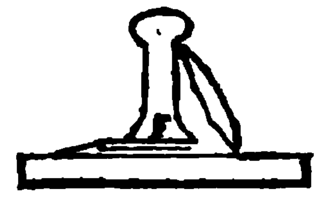


Fig. 17.



The improvement, it will be seen, consists in securing the wedge in position by a screw, bolt, or rivet passing in the same direction as the wedge, and passing partly through the wedge and partly through the chair. The head of the bolt acting upon the back of the wedge, and the nut working against the side of the chair. The wedge is screwed into its position, and not damaged, as at present, by being driven home by successive blows of a maul; and it is also retained in its position by means of the screw-bolt, which obviates the necessity for the constant attendance of a plate-layer to examine and tighten the wedge. The liability to accident consequent upon loose wedges will thus be also done

away with, and so both economy and safety be to a large extent ensured.

However, it must be observed, that this mode of securing the wedge is only applicable to chairs cast expressly for the purpose of this arrangement, and that to adapt it to the ordinary cast-iron chair of any of the various forms at present in use, the following subsidiary appliances (or other equivalent thereto) must be had recourse to.

Fig. 8.

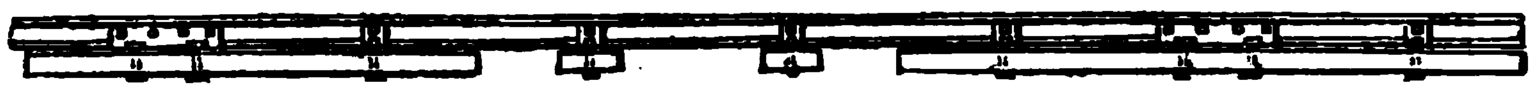


Fig. 7.

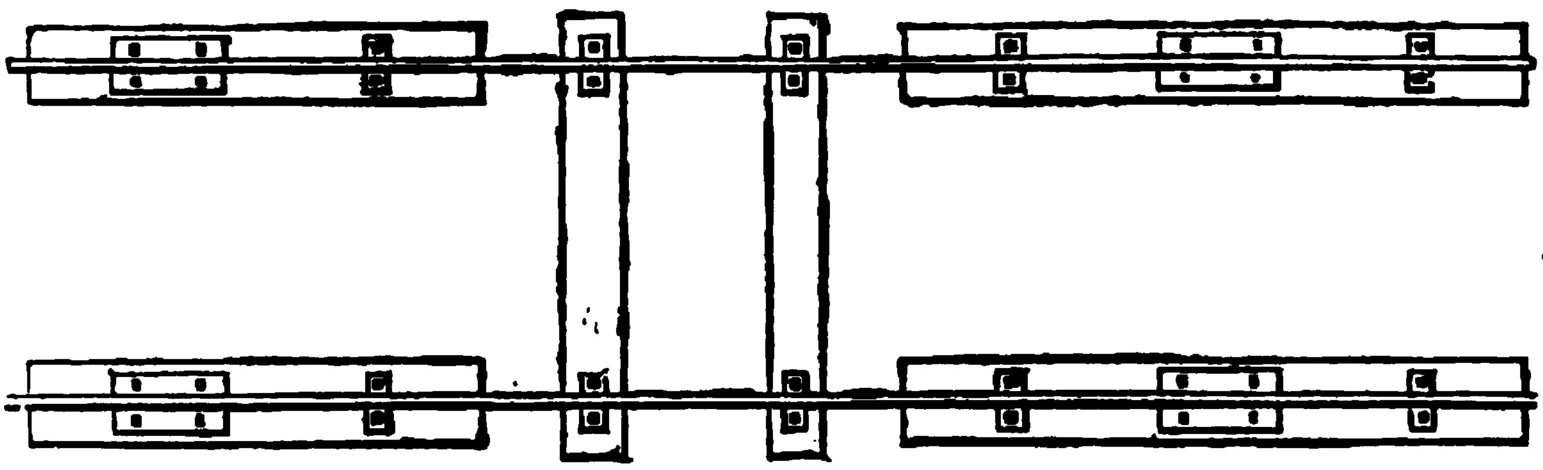


Fig. 9.

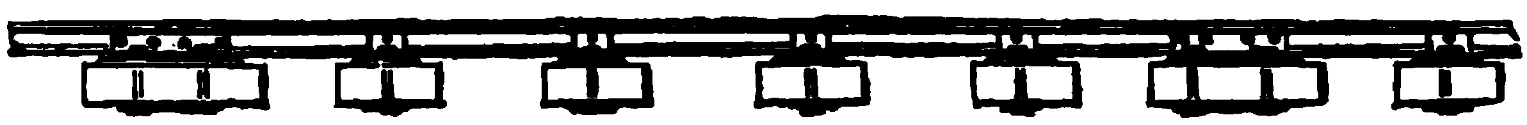
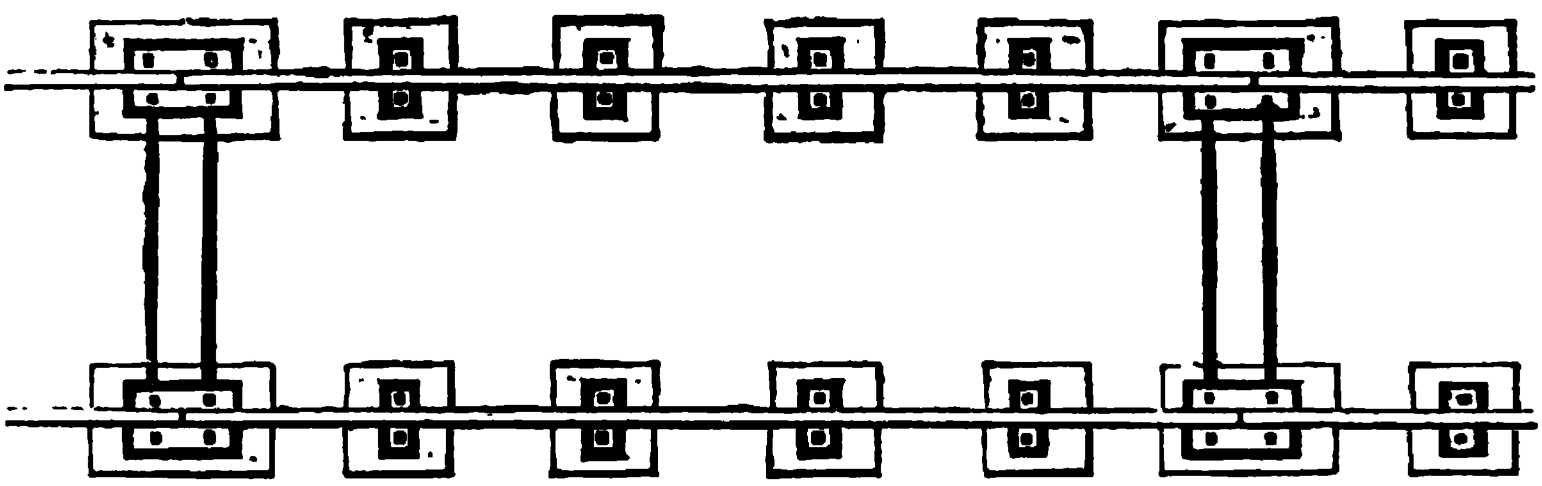


Fig. 10.



A small casting must be prepared similar to that shown in fig. 2, having a notch *a* to embrace the cheek of the chair, and a longitudinal hole or slit *b* for the bolt to pass through; the casting acting as a fulcrum to screw home the wedge, and the notch *a* in the casting securing it to the chair. Fig. 3 shows the small casting A in its position, embracing the chair and securing the wedge.

Secondly. My invention consists of laying the rails on chairs composed of malleable iron, and secured to sleepers of stone, wood, or metal by bolts or rivets, in the manner variously exemplified in figs. 4, 4^{a}, 5, 6, 7, 8, 9, 10, 11, 12, and 15. Figs. 4 and 4^{a} are transverse sectional elevations of a line of rails constructed on this plan. Figs. 5 and 6 are side elevations; A is the rail; B the malleable iron chair; C the bolts and nuts by which the chairs are secured to the sleepers S, which are in the figures represented as of wood. When the sleeper employed is composed of stone, or any metallic or hard unyielding substance, a piece of wood (of any convenient thickness), or layer of gutta percha, or other suitable elastic substance, is proposed to be placed between the chair and the sleeper, which will serve to

neutralize the destructive effects of vibration, and to obviate that rigidity which has been found objectionable in the case of the old stone sleepers, and in most cases also of the recent applications of cast iron to the same purpose. I prefer having the malleable iron chair (B) composed of two parts, as shown, so as to admit of being rolled into shape, and then cut off into the required lengths, and the bolt-holes pierced; but it may also, if found equally convenient, be rolled in one piece, as shown in fig. 15. Joint chairs should each be about 18 inches or 2 feet long, and secured to a longitudinal sleeper by bolts, as well as to the rails; the holes, either in the rail or in the chair, being elongated so as to admit of the necessary expansion and contraction. Intermediate chairs should be about four or five inches long, and attached to the sleepers by bolts or rivets, and to the rail also, if deemed necessary, by bolts or rivets. It is probable, however, that sufficient stability will be obtained by simply bolting or riveting the joint chairs to the rails.

In applying the malleable iron chair to sleepers of wood, I would recommend the arrangement shown in the plan and section

Fig. 11.

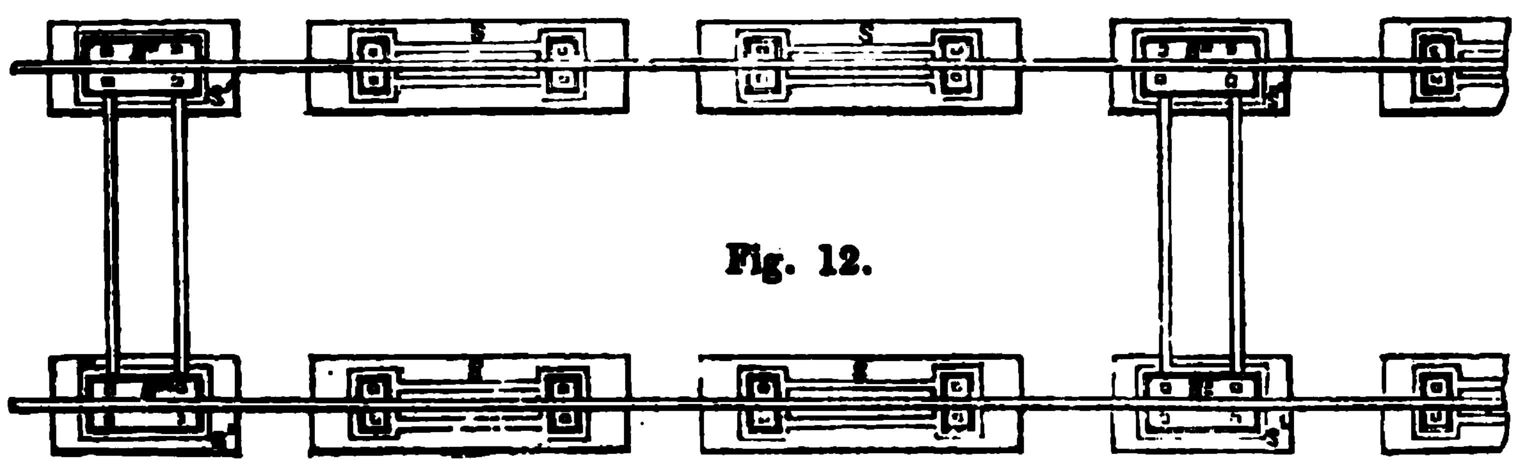


Fig. 12.

Fig. 13.

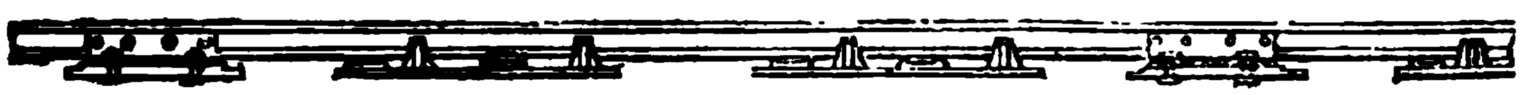
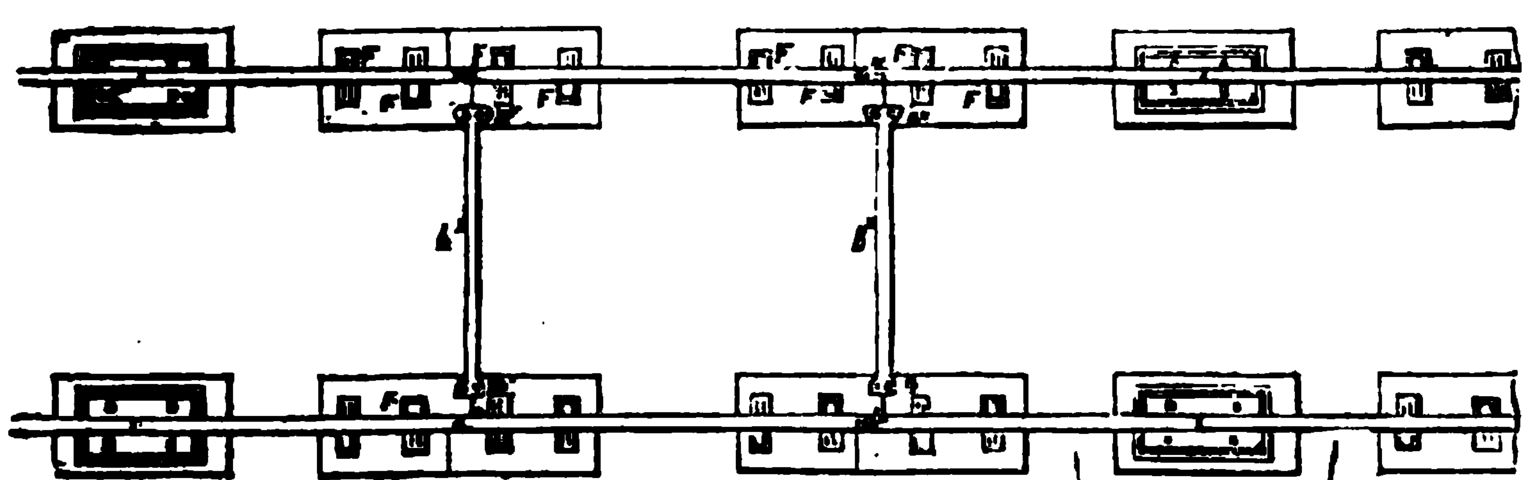


Fig. 14.



figs. 7 and 8. Here two longitudinal and two cross sleepers are employed for every 15 feet of roadway. The longitudinal sleeper under the joint of the rail should be about 9 feet long, and, in addition to the joint chair, there should be placed upon it an intermediate chair on each side of the joint chair. This arrangement would give great strength and stability to the joint of the rail, whilst the two cross sleepers to each 15 feet length of roadway would give a sufficient cross tie to preserve the gauge.

By making the sleepers 12 inches broad, the above arrangement would give a bearing surface of about 30 superficial feet to every 15 feet length of roadway. In bolting the chairs to the wooden sleepers, nuts may be used with the alternate corners turned up, for the purpose of becoming fixed into the wood, and so preventing them from being turned round when the bolts are being screwed tight (see figs. 4, 5, 6.) Instead of nuts being used, as above, a short bar may be substituted for the nuts, into which

the bolts could be screwed; or the bolts might be made to pass through a square hole in the short bar, with the head of the bolt resting against the bar, and the nut screwed down upon the malleable iron chair above the sleeper, as exemplified in figs. 14 and 15.

Figs. 9 and 10 show the modification which is to be made in this plan of railway construction when the malleable iron chair is laid on to stone blocks.

The stone-block under the joint of the rail, and which receives the joint chair, is shown to be 2 feet 6 inches long, by 1 foot 6 inches broad, and that under the intermediate chair 1 foot 6 inches by 1 foot 6 inches, which gives a superficial area or bearing surface of 25 feet 6 inches for every 15 feet length of roadway, and a thickness of 9 inches. The thickness of the stone might, however, have to be varied according to its quality and the facility of procuring a supply at any particular thickness from the quarry bed; strong slate, about 6 inches in thickness, might profitably answer the purpose. In attaching the malleable iron chair to stone blocks, the more convenient mode would be to place the heads of the bolts at the under side of the stone blocks, and the nuts above on the chair, the bolts passing through a short plate of iron with square holes to receive the necks of the bolts, and prevent them from turning round whilst the screws are being screwed down upon the chair above.

Whether stone blocks or cast iron sleepers are used, the gauge of the line is in either case preserved by means of bars of malleable iron, which may be secured in position by the same bolts which secure the chair to the block or sleeper. The number of these bars would be increased on curves, but on straight portions of the line one bar would be sufficient for every 15 feet length of roadway. A piece of soft wood, or other elastic substance, would be interposed between the stone block and the malleable iron chair, as already explained.

Figures 11 and 12 show in elevation and plan the mode of applying the malleable iron chair to cast-iron sleepers of any convenient form or size.

The joint sleeper S* will only have one joint chair, B*, attached to it at its great length, will be sufficient to give the necessary bearing surface and stability to the joint of the rail. The intermediate sleepers S S will generally be of such a form and size as to admit of two malleable iron chairs being raised on each sleeper; but it may frequently be found more convenient so to proportion the size and form of the cast-iron sleeper as to admit but one malleable iron chair to be attached to each sleeper, according to the nature of the traffic and of the ground upon which the superstructure is laid. In attaching the malleable iron chair to the cast-iron sleeper, the head of the bolt should be placed below the chair, and a square projection cast upon the sleeper round the bolt hole, into which the head of the bolt would fall, and by which it would be prevented from turning round when the nut was being screwed down. A piece of soft wood, or other elastic substance, would be interposed between the cast-iron sleeper and the malleable iron chair, as already explained in reference to the stone blocks.

Thirdly. My invention consists of a method of railway construction represented in fig. 13 (side elevation) and fig. 14 (plan), in which intermediate sleepers are employed with chairs cast in one therewith, so as to do away with bolts and keys altogether as fastenings for the rails. Figs. 16 and 17 are cross-sections of rails laid on this plan, but each showing a variation in the form of the rail. The chairs are cast so that the cheeks do not come opposite each other, but they are at such a distance apart that when the two castings are laid obliquely in contrary directions under the rail, the latter comes between the cheeks after which the castings are pressed in opposite directions until the notches at a^* fit into each other; and when this is effected, the cheeks of the chairs will be brought in close contact with the rail, and the interlocking of the notches will prevent the cheeks of the chairs from releasing the rail; the tie-bars b^*b^*, which are necessary for the purpose of keeping the gauge, are placed at the junction of the two sleepers or castings, and bolted to each of them, as shown at a^1, a^1, a^1, a^1, fig. 14, and afford additional security that the notches will not be disengaged from each other by the action of the railway trains. To prevent rigidity, as also the vibration of the trains from transmitting a destructive effect to the chairs and sleepers, pieces of wood, FF, figs. 16 and 17, are placed under the rail in rectangular cavities or receptacles, about three-eighths of an inch deep, and as broad and long as the casting will admit of, so that a small margin may remain to confine the wood in its place while being pressed upon by the rail. The wood should be about three-quarters of an inch thick, and there should be a groove or slit leading from any convenient part of the concavity or receptacle to prevent water or damp from accumulating to injure the wood.

And having now described the nature of my said invention, and in what manner the same is to be performed, I declare that the improvements in railway construction which I claim are as follows:

First. I claim the method of securing the wedges of cast-iron chairs in position by means of screw-bolts and rivets, as before described.

Second. I claim the method of railway construction represented in figs. 4, 4*, 5, 6, 7, 8, 9, 10, 11, 12, and 15, hereinbefore described, in so far as respects the mode or modes therein employed of combining malleable iron chairs with wood sleepers, or with stone, or other rigid sleepers.

And, third, I claim the method of railway construction represented in figs. 13, 14, 16, and 17, and before described, in so far as respects the employment of intermediate sleepers having chairs cast in one therewith, so as to obviate the necessity for bolts or keys.

GEORGE DISMORE, of Clerkenwell-green, jeweller. *For improvements in locks.* Patent dated November 6, 1851.

These improvements have relation principally to locks into which the key is introduced through a tubular opening; they comprehend also an improved construction of key, in which the "bit" is made detachable from the "stem," so that in the event of either one or other of the parts being lost, the finder would be unable with one part only to obtain access to the lock.

Claim.—The improvements described.

WILLIAM THOMAS, of Exeter, engineer. *For certain improvements in the construction of apparatus for economizing fuel, and in the generation of steam, and in machinery for propelling on land or water.* Patent dated November 6, 1851.

These improvements comprehend—

1. A peculiar construction of steam boiler, in which tubes of a bent or syphon-like shape are employed, in conjunction with the admission to the boiler of heated air under pressure, to promote combustion, and the use of feed-water heated before entering the boiler.

2. The application of auxiliary fly-wheels to the wheels of locomotives, to paddle-wheel, and screw-propeller shafts, to render effective in propelling the centrifugal force generated by the revolution of the said wheels and propellers. The fly-wheels, which are rather heavily weighted, are attached to the driving and other wheels of locomotive engines, either inside or outside of the framing, and to paddle-wheels either outside or inside of the wheel, or at the centre of the wheel when divided floats are used. The effect of the fly-wheels is to be regulated by bringing the weights employed in them nearer to the centres of the wheels.

3. An air engine for propelling and motive purposes generally.

MICHAEL LEOPOLD PARNELL, of Little Queen-street, Holborn, ironmonger. *For certain improvements in locks.* Patent dated November 6, 1851.

Claims. — 1. The construction of keys with sliding bits moved in and out by an eccentric or eccentrics contained within the lock.

2. The application to "tumbler" locks, where an expanding bit key is used, of a revolving cap, alone or in combination with detector apparatus.

3. The application to "tumbler" locks generally of a spring stop acting against the tumblers, to prevent their sticking.

THE EXCISEMAN'S STAFF QUESTION.

Sir,—Mr. Tebay has transmitted to me the following *errata* in the printing of his solution to the "Exciseman's Staff Question," which you will please to insert as soon as convenient:

Page 345, col. 2, line 6, *for* "force about it," *read* "force about A."

Page 345, line 7, *for* "AD," *read* "δD."

Page 345, line 16, *for* "moment about it," *read* "moment about A."

Page 345, line 22, *for* "of this staff," *read* "of the staff."

Page 345, line 26, *for* "$(\frac{1}{2}\cos.^2\beta+1)$," *read* "$(\frac{1}{2}\cot.^2\beta+1)$."

Page 346, line 1, *for* "When," *read* "Then."

Page 346, line 4, *for* "$(l-m\mathrm{D})$," *read* "$(l-m)\,\mathrm{D}$."

Page 346, line 9, *for* "cos. β," read "cot. β."

Page 346, line 10, *for* "cos. β," *read* "cot. β."

Page 346, line 37, *for*

"cos. $\beta=3{\cdot}73530469$,"

read

"cot. $\beta=3{\cdot}73530469$."

He also adds, that "Mr. Wolfenden, instead of taking the 13 inches *along the axis* of the staff, took them along the *under* side (viz. AB=13), which will necessarily make his result *less* than the others."

I am, Sir, yours, &c.,
T. T. WILKINSON.

Burnley, Lancashire,
May 6, 1852.

WEEKLY LIST OF NEW ENGLISH PATENTS.

George Robins Booth, of the Wandsworth-road, Surrey, for improvements in the manufacture of gas. May 8; six months.

George Frederick Muntz, Jun., of Birmingham, for improvements in the manufacture of metal tubes. May 8; six months.

Joseph Jepson Oddy Taylor, of Gracechurch-street, London, naval engineer, for improvements in ships, boats, and vessels, and in certain articles of ship's furniture. May 8; six months.

William Littell Tizard, of Aldgate, High-street, London, brewers' engineer, for improvements in machinery, apparatus, and processes for the preparation of grain, and for its conversion into malt, saccharine, vinous, alcoholic, and acetous liquors. May 8; six months.

Alexandre Jules Saillant, Jun., of the Rue Vivienne, Paris, tailor, for certain improvements in the manufacture of articles of dress. May 8; six months.

John Campbell, of Bowfield, Renfrew, N. B., bleacher, for improvements in the manufacture and treatment, or finishing of textile fabrics and materials, and in the machinery, or apparatus used therein. May 8; six months.

William Gillespie, of Forbane Hill, Linlithgow, Scotland, gentleman, for an improved apparatus, instrument, or means for ascertaining or setting off the slope or level of drains, banks, inclines, or works of any description, whether natural or artificial, or under land or water. May 8; six months.

William Armitage, of Manchester, for an improved safety envelope, and certain improvements in the machinery to be used in the manufacture of the same. May 8; six months.

Peter Fairbairn, of Leeds, York, machinist, and Peter Swires Horsman, of Leeds aforesaid, flax-spinner, for certain improvements in the process of preparing flax and hemp for the purpose of heckling, and also machinery for heckling flax, hemp, China grass, and other vegetable fibrous substances. May 8; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
May 7	3244	G. Holcroft	Manchester	Steam boiler.
,,	3245	S. Woodbourne	Liss	Horse rake.
10	3246	W. Dray and Co.	London-bridge	Right and left-hand hill-side plough.
11	3247	A. Marion and Co.	Regent-street	Combined pen-cleaner and stopper.
12	3248	J. Winterbottom	Yorkshire	Jar and bottle stopper.
,,	3249	R. Marples	Sheffield	Pad for joiners' brace.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
April 29	409	H. Maling	Home-office	Elevation sight for ball-shooting.
,,	410	H. Maling	Home-office	Projectile for a smooth or rifle-barrelled gun.
,, 30	411, 412	H. Maling	Home-office	Forms of rifling for fire-arms.
May 4	413	H. McLean, R.N.	Horton-street, Kensington	Writing, reading, and music desk, and travelling case.

CONTENTS OF THIS NUMBER.

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1502.] SATURDAY, MAY 22, 1852. [Price 3d., Stamped 4d.

Edited by J. C. Robertson, 166, Fleet-street.

MARYON'S PATENT GUN-CARRIAGES AND TRAVERSING APPARATUS.

Fig. 1.

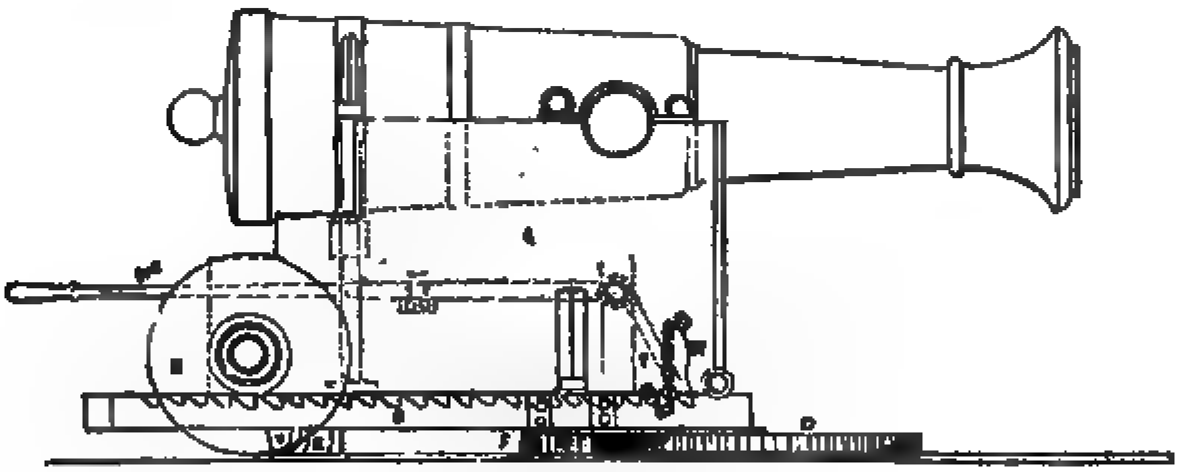
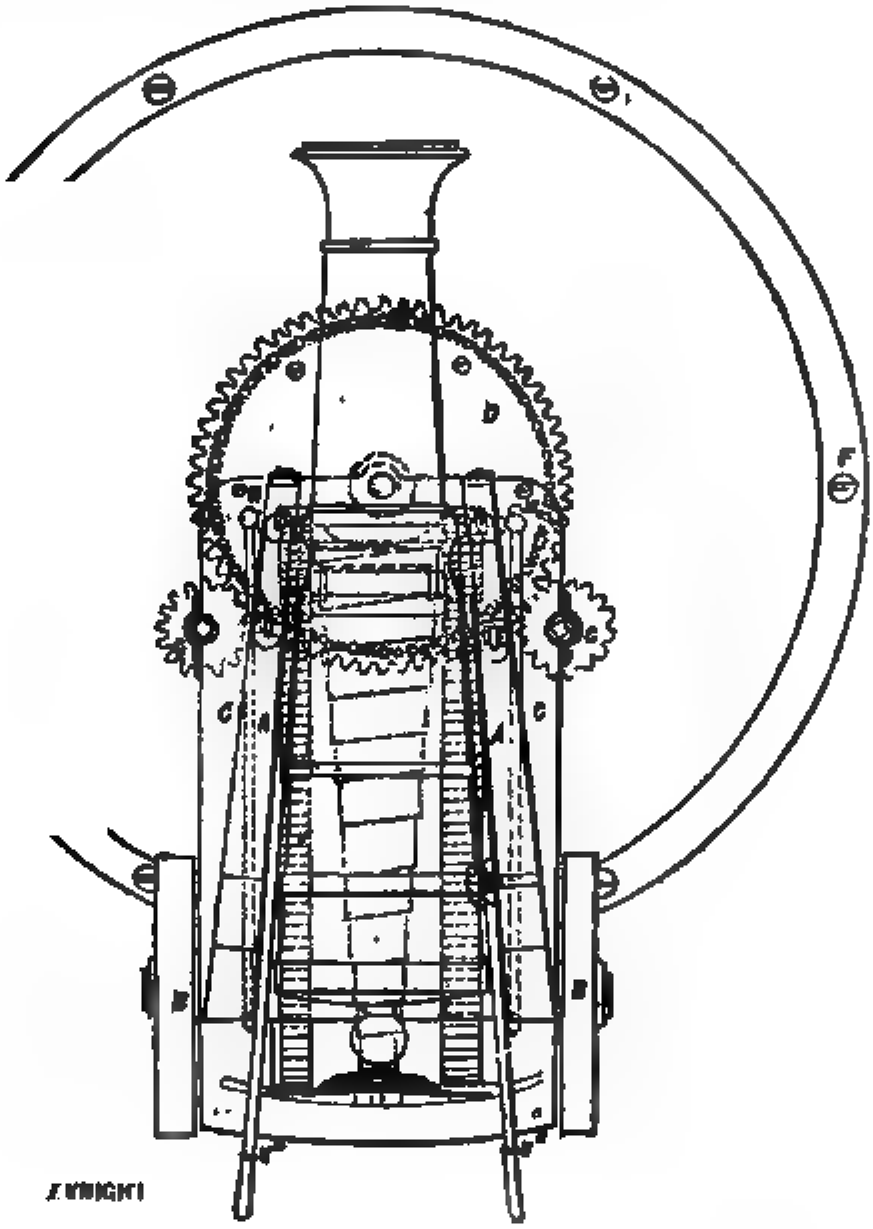


Fig. 2.



MARYON'S PATENT GUN-CARRIAGES AND TRAVERSING APPARATUS.

(Patentee, Mr. Robert James Maryon, of the York-road. Patent dated October 10, 1851. Specification enrolled April 10, 1852.)

Specification.

FIGURE 1 is an elevation, and fig. 2, a plan of a gun-carriage constructed according to my invention. AA is the gun-carriage which has two bearing-wheels, BB; at the fore end it rests by two friction rollers upon a traversing or moveable bed C, which is furnished with an axis or pin at the front, which takes into the boss of a fixed toothed-plate D, and around which it is free to turn, so as to bring the gun into the desired line of direction. To facilitate these movements the back end of the traversing bed is supported by conical-rollers EE, which run upon a circular ring or rail F. GG are two pinions which are affixed to the lower ends of spindles which have their bearings on the side of the gun-carriage, and gear into the teeth of the plate D; to the upper ends of the pinion spindles there are fitted crank handles (made to ship and unship), by turning which the gun-carriage and traversing bed are moved round upon the axis or centre, in front of the traversing bed, till the gun has been brought into the proper position; when the elevation or depression of the gun is next effected by means of a horizontal screw, which turns in bearings affixed to the gun-carriage, and placed immediately underneath the gun. Fig. 3 shows this part of my invention detached from the other parts. I, is the gun; K the screw, which is actuated by a crank handle K^2; L is a nut which takes upon the screw, and is connected to the gun by a rod M, which is jointed at its ends, both to the nut and to the gun. By turning the crank handle one way or the other, the gun is either raised or depressed accordingly. Fig. 6 is a separate plan of the traversing bed. T is a conical spring, made of broad flat bar steel, the front end, t^2, of which bears against the inside of the breast of the gun-carriage, while the other end rests upon an elliptic spring which bears upon the traversing bed. When the gun recoils upon being fired the springs are compressed between the carriage and the traversing bed. U is a pawl-plate, which is jointed to two levers; U^2 U^2; the pawl-plate falls into the ratchet tooth racks, U^3 U^3, formed in the upper surface of the traversing bed, and keeps the gun-carriage from again running forward by the impulse of the springs when the recoil has taken place. After the gun has been reloaded the pawl-plate is raised up by pressing down the levers, U^2 U^2, when the force of the springs instantly causes the gun-carriage to run forward into its place; but to prevent any concussion which might arise from the suddenness of the action, there are cushions of vulcanized India-rubber interposed between the gun-carriage and the traversing bed at the two extreme ends of the springs. VV are two slots formed in the traversing bed, through which slots there are passed two guide or pilot bolts, connected by lugs formed on the sides of the gun-carriage, which serve to guide the course of the gun when it recoils, and to connect the carriage and traversing bed together. WW are locking bolts, or belay pins, by which the traversing bed is fixed to the plate D, which plate is graduated, so as to designate the number of degrees the gun is turned round from any determinate line. Fig. 7 is a plan of so much of these gun traversing arrangements as is necessary to explain the method of working ships' port guns, or battery guns, according to the method just explained. In applying the traversing bed to guns of this class, it is necessary to give a lateral range of motion to the fore-part of the traversing bed (instead of having it turning round a fixed point, as in the case last described), to prevent the muzzle of the gun coming in contact with the sides of the port-hole, which would otherwise require to be unusually large to admit of the gun having a sufficient amount of horizontal range. AA is the port-hole (it may either be of a ship or battery). The traversing bed has its fore-end connected by an eye-bolt to a strong iron bar C, of a segmental shape, the two ends of which are securely fixed to the sides of the port-hole; D is a segmental plate, which has its outer periphery furnished with teeth, into which the pinions attached to the gun-carriage gear as before explained. Instead of having a toothed segment and pinions, as just mentioned, for enabling the men at the gun to bring it to the line of direction, the same object may be effected by having a plain segment, and using what is generally known as a "nipping lever purchase." The

arrangements which have been described, when applied to ships' guns, will enable much of the present tackle now employed to secure the guns to be dispensed with,

Fig. 3.

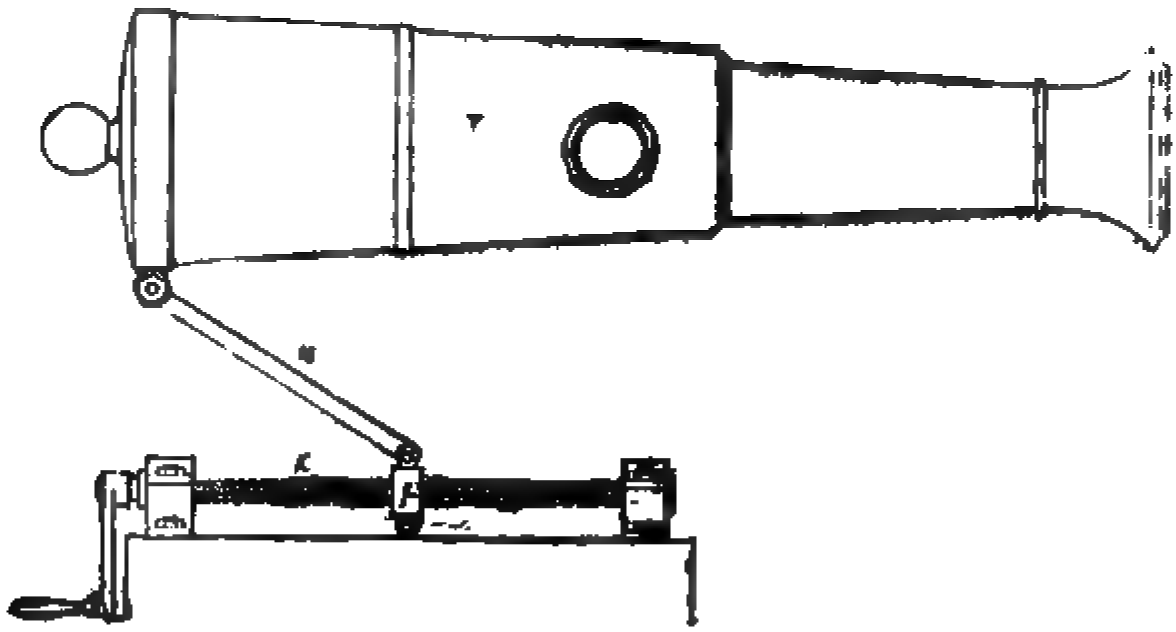
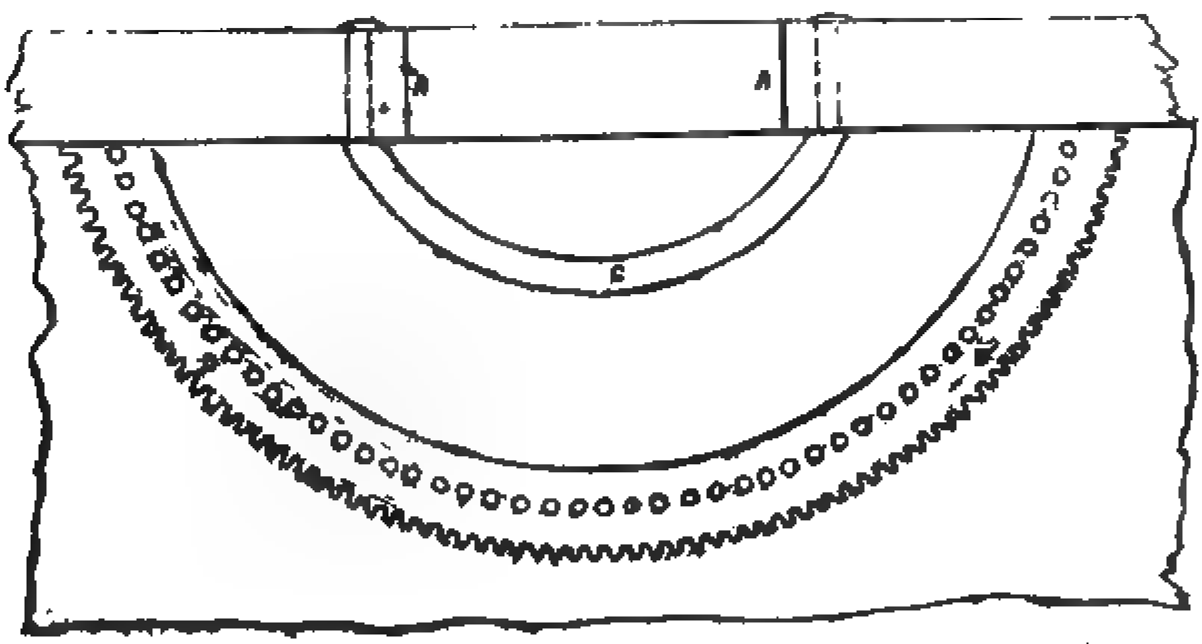


Fig. 6.

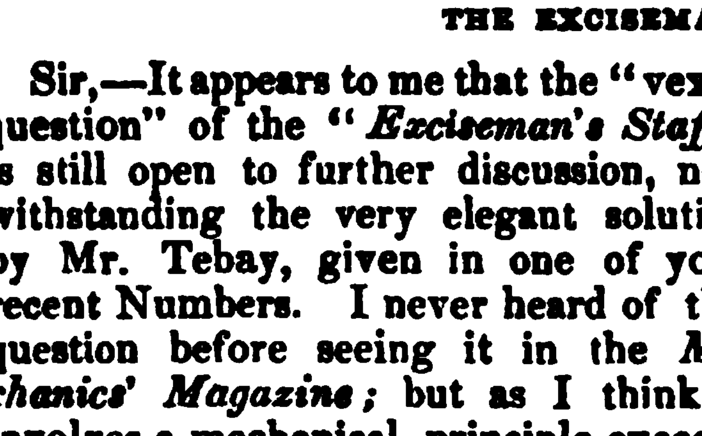
Fig. 7.



such as side, lee, or luff, or trail tackle, and also the breeching; the traversing bed and holding bolts serving in their stead. Sometimes I work ships' guns by having an auxiliary carriage placed within the gun-carriage, but having the axes of the wheels or rollers, upon which it runs, at right-angles to the axes of those of the gun-carriage. The auxiliary carriage is acted upon by two levers, jointed to the sides of the gun-carriage, in such way that when the ends of the levers are depressed the whole weight of the gun and its carriage is thrown upon the wheels of the auxiliary carriage, the gun-carriage wheels for the time being raised just clear of the deck, in which situation the gun can easily be moved about by handspikes, so as to be brought to the intended line of direction; when, by again slacking the levers acting upon the auxiliary carriage, the weight may be permitted to fall upon the gun-carriage wheels.

THE EXCISEMAN'S STAFF QUESTION.

Sir,—It appears to me that the "vexed question" of the "*Exciseman's Staff*" is still open to further discussion, notwithstanding the very elegant solution by Mr. Tebay, given in one of your recent Numbers. I never heard of this question before seeing it in the *Mechanics' Magazine*; but as I think it involves a mechanical principle exceedingly valuable in itself, and one, moreover, with which every practical engineer should be well acquainted; and as I apprehend the true conditions of the equilibrium have not yet been assigned, I beg to submit the following investigation, which perhaps will be found to throw some further light upon this singularly unfortunate problem.



Let AL be the axis of the staff; KQ, the surface of the fluid; G, the centre of gravity of the staff; B, centre of buoyancy of the part of it immersed. Put AG $=a$, AB $=b$, LX $=d$, radius of cylinder $=r$, density of fluid $=\delta$, and $\angle$ AXk (given by the problem) $=\theta$. Through the centres B and G, draw the verticals BN, MG; let P be the point about which the moments are measured, and draw PM, PN, perpendicular to the verticals. Representing by W and B the pressures which act at G and B respectively, we have for the equation of equilibrium (neglecting friction for the present).

$$W \,.\, \overline{PM} = B \,.\, \overline{PN} \,\ldots\ldots\ldots\, (1).$$

Now,

$$PM = a \cos.\,\theta + r \sin.\,\theta. -$$
$$PN = b. \cos.\,\theta + r \sin.\,\theta. -$$
$$B = r^2 \pi\, d\, \delta. -$$

Substituting these values in equation (1) and solving for W, we find,

$$W = r^2 \pi d \delta . \frac{b. \cos.\,\theta + r \sin.\,\theta}{a. \cos.\,\theta + r \sin.\,\theta} \,\ldots\ldots\ldots\, (2.)$$

Taking the numerical values given by the problem,

$a=18$, $b=24{\cdot}5$, $d=23$, $r={\cdot}375$, $\delta={\cdot}5949$, and $\theta=14^\circ,, 59',, 20''$;

and performing the calculation indicated in (2), W will be found 8·21556 oz. by this solution.

Let the friction of the surfaces at the point P be now taken into consideration, and suppose the cylinder in the state bordering upon motion. It is evident that there are two such states—that it may be upon the point of sliding *upwards* or *downwards* according as the component of B, or that of W, in the direction of the axis of the cylinder, is about to preponderate. Equation (1) will therefore assume the form

$$W.\overline{PM} \pm F = B \,.\, \overline{PN} \ldots\ldots (3).$$

Let ϕ be the limiting angle of resistance of the surfaces at P; $(W-B). \cos.\,\theta$ is the pressure at P producing friction. $\therefore (W-B) \cos.\,\theta. \tan.\,\phi = F$.—Now the components of W and B, in the direction of the axis, are respectively W. $\sin.\,\theta$, and B. $\sin.\,\theta$;

$\therefore (W-B) \sin.\,\theta = (W-B). \cos.\,\theta. \tan.\,\phi. -$

$\therefore \tan.\,\phi = \tan.\,\theta$, and $\phi = \theta. -$

Whence $F=(W-B) \sin.\,\theta$; and sub-

stituting in (3.) the values before found,

$$W.\{a.\cos.\theta + r\sin.\theta\} \pm (W - B)$$
$$\sin.\theta = B.(b.\cos.\theta + r.\sin.\theta),$$

from which, by reduction, we find

$$W = B.\frac{b.\cos.\theta + (r \pm 1).\sin.\theta}{a.\cos.\theta + (r \pm 1).\sin.\theta} \ldots\ldots (4).$$

the sign + or − being taken according as the cylinder is in the superior or inferior state bordering upon motion.

Restoring the value of B before given, using the numericals previously employed, and performing the calculations indicated in equation (4), the following results will be obtained:

	ozs.
1. On the point of sliding *upwards*........	W = 8·18387
2. On the point of sliding *downwards*......	W = 8·24819
3. Friction being neglected..............	W = 8·21556

From this investigation it appears to me that the question, as originally given by the proposer, is *unlimited* by his data, because he does not say that friction is to be neglected; and if it be taken into account, the values of W between the *superior* and *inferior* states bordering upon motion may be infinite in number without disturbing the equilibrium. To those who have studied the equilibrium of a machine, this will appear evident.

The difference between the extreme values of W, as shown above, is ·06432 ozs., and the weight found on the supposition of no friction bisects this difference. We are, therefore, certain that the *true* weight of the cylinder lies somewhere between

$$8·21556 \pm ·03216;$$

but even in this small range, an infinity of values may be assigned.

I am, Sir, yours, &c.,

T. Smith.

Bridgetown, Wexford,
May 10, 1852.

BLOWING FANS.

Sir,—I submit to such of your readers as are conversant with mechanical engineering, a modification of the blowing fan. It appears to me that there are several objections to the one in common use. The air propelled by the leaf just after passing the exit pipe has to move along nearly the whole of the circumference of the case before arriving at the outlet—a long journey attended with much friction. The same may be said in a less degree of the air discharged by the leaf during the rest of its course. Again; the initial direction of the air is at right-angles to the leaf which propelled it, that is, tangential, there must be consequently a diminution of velocity while the current is acquiring the direction of the casing of the fan. The progress of the current is afterwards interfered with by fresh discharges of air by the leaf, the direction of which, if carried on, would cut it across, and intercept it. In short, the air propelled by the leaf in each successive point of its course opposes that discharged at the previous point. We may imagine the turbulent commotion produced by conflicting currents of air moving at the rate of a mile a minute. The evil increases as the leaf advances, for then, while it discharges air with the same force as at the commencement of its revolution, the velocity of the previous discharges has been diminished by friction and interference.

If the above objections be well founded, we may conclude that a leaf of a blowing fan supplies much less air to the exit pipe at the first part of its revolution than at its last part.

To remedy these defects, I propose to substitute a pear-shaped casing for the eccentric. The fan is to be placed within the thick end of the case, the side facing the pyriform chamber being closed by a circular plate, and there being only one opening for the admission of air at the centre. By this arrangement the outlet would be exactly opposite the inlet, the air entering the spheroidal end of the case, and issuing from the other end terminating in a pipe. The air discharged by the leaves of the fan would immediately enter the pyriform chamber, being guided by the curvature of its sides, and moving perhaps somewhat spirally, but always towards the outlet. That part of the chamber in which the fan is placed

would be immediately cleared of the air delivered by the leaves and room left for more. The air discharged at each successive point of the revolution of a leaf would have, so to speak, its own separate channel, or line of movement in the pyriform chamber, and all going in the same direction, and with the same speed, there would be little mutual interference of the different currents. The course of the air being gradually directed towards the outlet, there would be less friction than in the eccentric fan. I speak of different currents for the convenience of description; but, in fact, there would be only one current flowing from the extremities of the fan, which lining, as it were, the interior of the chamber, would proceed to the outlet. It is probable, that if the curvature of the casing were perfect for the purpose, there would be a tendency to a vacuum in the interior of the chamber opposite the centre of the circular plate closing the side of the fan; if so, a pipe communicating with the exterior, and terminating at that situation, would afford an additional supply of air.

The size of the chamber and the nature of the curve of its sides I leave to professional engineers. The exhausting fan, in which there is free passage into the open air from the extremities of the leaves must, I should think, discharge a greater quantity of air than the blowing fan, and it would be interesting to compare the powers of the two by experiment to ascertain the loss sustained by forcing the air through a confined outlet. We may infer, that the larger the pyriform chamber, the more effective would be the fan, as it would then approach nearer to the circumstances of the exhausting fan.

Some years since I commenced an attempt to give the above plan a trial, but the difficulties and expense were too great for an amateur in such matters to contend with. For the purpose of delivering myself of the idea, I request the insertion of it, if you think it worthy of a place, in your valuable Magazine.

I am, yours respectfully,

THOMAS HAYWORTH, M. D.

Bowdon, Cheshire, May 18, 1852.

THE ECONOMY OF KEEPING READY.

It was no new discovery that apparatus of all kinds is best kept in working order by constant use; but few persons have turned their attention to the making engines provided against emergencies available also for ordinary purposes, thus not only ensuring a constantly good state of the apparatus itself, but also the equally important purpose of habituating its workers to its employment. Late disasters at sea leave us to deplore the sad consequences of neglecting this interconvertibility. Had ready means of extinguishing fire, and ready hands to employ them, been on board the *Amazon*, her destruction might probably have been averted; and there seems a general impression that had her boats, and also those of the *Birkenhead*, been in frequent use, they would have been available in saving many a valuable life. This interconvertibility, or in other words, applicability of the same article to a variety of purposes—that is, where no one of them is constant, was a principle always frequent in Bentham's mind, as was evinced in his report to the Admiralty, 19th of Dec., 1796. Their Lordships had referred for his opinion a proposal of Mr. Taylor's respecting a forcing pump, and the substitution on board ship of leather hose, in lieu of the usual wooden pump-dales. He reported, that in his conception the hose was "a very useful improvement," and that "the having on board-ship, one or more pumps, that should answer at the same time the purpose of pumping the ship, and pumping up clean water, could not but be desirable." He stated some objections to the pump and mode of fitting it, and added, "considered as an engine for extinguishing fire, the preparation of Mr. Taylor's apparatus, seemed to take up too much time for a business in which expedition is of so much importance. The hose also was very leaky, and burst while working . . . . but this unfitness from the decay of the hose proves how little an apparatus of that kind is to be depended on when not in constant use." He then suggested various improvements of the pump and its fittings; and concluded by saying, that "the adjustments of the working part of such pumps, as also their number and situation, would be influenced by the considerations contained in the enclosed paper."

That paper was dated 20th December, 1796, and was as follows:—

Portsmouth, 20th December, 1796.

Suggestions respecting the various uses to which an apparatus for raising water by means of a forcing pump is applicable on board ship, submitted for their Lordships' consideration; and upon which some decision is requested, for the purpose of establishing the services to which an apparatus of this kind should be adapted,

1st. With respect to the important purpose of extinguishing fire, it is conceived that the whole apparatus to be used in cases of such emergency should, as far as possible, be no other than what is in daily use for ordinary purposes.

2nd. It appears desirable at the time of preparing for action, to have an easy mode of wetting sails, rigging, decks, upper works, and in general, all parts of the ship where wetting would not be injurious.

3rd. It appears from theory that the wetting the sails of a ship should increase the advantageous action of the wind upon them, not only by closing up the interstices between the threads of which they are composed, but likewise making the sails stand *flatter*. The custom of wetting the sails on board small vessels, the only ones where the expedient is at present practicable, seems to confirm the idea of its supposed utility.

It is customary to have a cask of water on the tops of ships in time of action, ready for a quantity to be thrown by means of ladles or scoops upon sails or cordage on fire. A small kind of fire engine by affording means of throwing the water with more certainty, as well as to a greater distance, would enable a small quantity of water to be made more serviceable.

Should it be thought expedient to wet the sails for the purpose of increasing the advantageous effect of the wind, it would be from the tops that this business would be best done; and the apparatus proposed for this purpose would be one that would always be kept in good order, and therefore in readiness for the extinguishing fire during action or otherwise.

Should the wetting of sails and rigging on any account be thought necessary, the uses to which an apparatus for raising clean sea-water on board ship might be applied would be as follows:—

1st. The forcing water in hose, or pipes, to the tops to supply the engine fixed there.

2nd. To distribute water in large quantities to any part of the interior of a ship, in case of fire, and particularly to the magazine.

3rd. By the addition of the engine-pipe to the end of the hose, the throwing the water to any height not exceeding that of the main-top, for the purpose of wetting the lower sails and rigging.

4th. To drive the water with force, and in large quantities, upon the decks to wash them, instead of using buckets for that purpose.

5th. For the supplying the salt-water used in cooking, distilling, and washing of all kinds.

For each of these five purposes the pump itself would be used, and therefore no danger of its remaining out of order by neglect. For the first three purposes the hose would be necessarily used, and for the fourth and fifth, it might be ordered to be so. Should the practice of wetting sails be established, that alone might afford security that a fire-extinguishing apparatus would be always in order. Should there be objections, which I am not aware of, to wetting the sails, it would then become necessary to find some other *constant* use for the hose provided against cases of danger. On this account it would appear worth while to enforce by the strictest orders the employing the hose at all times for washing the decks and upper works; the means it affords of dashing water with force into crannies and corners could not but facilitate this business. The little difficulty arising from the unwieldiness of so long a hose, the precautions necessary in moving it about to avoid twisting and entangling it, so likewise the inconvenience and discomfort arising from any leak in the hose, would altogether ensure the management of it being well understood, and its being kept in the best working condition, ready to be employed when called for to perform the important service for which it was chiefly designed.

SAMUEL BENTHAM.

FORMS OF WHEEL TEETH.

Sir,—Observing that an extract from the Transactions of the Society of Arts for last year, in which some remarks I made on the form of wheel teeth are imperfectly rendered, has been copied into your Journal (see *ante* p. 372), I take the opportunity of making a few observations on the subject.

It has been a prevalent notion that correctness of form in the train wheel teeth constituted a considerable element towards accuracy of going in timekeepers, and I now propose giving my reasons for dissenting from this opinion.

The question of the advantages obtainable from correctness of shape in the teeth may be considered under two heads:

1st. What additional accuracy would perfectly-formed teeth effect in the rate, or time, from a smaller variation of the force transmitted by them to the escapement?

2ndly. How much would correct form contribute to the durability of the timekeeper?

Beginning with the first point: If the worst form of train-wheel teeth, at present in use, be compared with the best form that can be given to them, the difference between the two, of the power transmitted, will not probably amount to 20 per cent.; we will, however, set it down at that. Now it must be remembered that it is not the quantity of power required to produce a given arc of vibration, but a variation of the power that can cause any change of rate; this 20 per cent. would therefore have to be reduced until the difference between the two forms of teeth, in producing a variation in the power transmitted during one interval over another, had been arrived at; but as this would at once render the amount so small as to leave very little to argue about, I propose to leave the whole 20 per cent. as the difference of variation caused by the two forms. That is, that the worst formed teeth at present in use shall alone cause the power to vary 20 per cent. more than the variation due to the best form.

We will now turn to the causes that exist having a tendency to neutralise any irregularity of rate arising from the teeth.

In the first place, then, whatever difference of force may occur, either from badly cut teeth, or from the wheels and pinions being out of truth, that is not concentric with the pivots—an error quite distinct from the form of the teeth—it will correct itself after one revolution of the respective wheels or pinions, for the error will then occur over again in the same order to the same amount, and as the slowest wheel in the train of a watch or 54-hour chronometer revolves several times in a day, the error occupying the longest interval would be corrected every five or six hours, while that of the quickest wheel would be corrected after an interval of a few seconds.

Again; in chronometers and the finest sorts of watches, there is a correction applied, called the isochronous adjustment of the balance-spring, which will neutralise any irregularity in the power transmitted by the train, whether it may arise from imperfectly formed teeth, a variation in the main-spring adjustment, or from the far more potent cause of the oil becoming thick, and the chronometer dirty. If this correction has been properly made, it will enable the chronometer to keep the same time under a variation in the impulse of from 4 to 1, or a difference of 400 per cent.,—an amount in comparison with which the 20 per cent. I allowed as the variation between well and ill-shaped teeth would have formed but a small item, even though it had not been of a character to correct itself in the manner I have described.

If it were necessary to advance further evidence to prove how little the form of the train-wheel teeth has to do with accuracy of time-keeping, I might mention the fact that the teeth of the finest chronometer will not generally be found more perfect in form than those of the commonest watch.

With reference to the second point—that of durability—there does not appear much reason to be very sanguine about the efficiency of the epicycloidal principle, especially as regards watch-work, in which it is well known the wheels and pinions are the last parts to wear out. Any advantages which the principle may possess will, therefore, be better manifested where the power applied is considerable,—as in the main wheel of chronometers, the instance noticed by Mr. C. Frodsham, and the wheels of large clocks; but, from all I have observed in practice, I am inclined to attach less importance to the shape of the teeth, as essential to durability, than to the hardness of the brass and steel of which the wheels and pinions are composed; indeed, I had lately an instance before me, in an astronomical clock, probably eighty years old, bearing the eminent name of Arnold, in which the main-wheel teeth had not been cut, but filed into shape, according to the old practice, and, consequently, presenting a great *variety* of forms; yet I did not perceive one tooth worn more than another, and so little were the teeth worn at all, that the full breadth of the wheel had not come into bearing, although the going weight was 16 lbs. (it being a month clock); a proof that if the horologists of the last century neglected the epicycloidal principle of wheel-cutting, they did not fail to introduce some quality at least equally effective.

Should any one, however, wish to test by experiment how much perfectly shaped teeth will diminish the wear, they could have a wheel cut with several forms of teeth in it, taking the precaution to see that the brass is equally hammered.

In making these observations I do not wish it to be understood that I oppose the endeavour to obtain more perfect curves from the wheel-cutters, especially as one form may be as easily cut as another, after the cutter has once been made; but I wish to place the question in its true light, and show that it is one simply of wear and tear, and not of accurate time-keeping, and that the hardness of the wheels and pinions, the suitability of the materials, and the smoothness of the acting surfaces, will enter quite as largely into the question of durability as perfection of form in the teeth.

I may observe that the advantage of a correction for any variation of the force transmitted by the train, has lately been extended to clocks; and experiments made under the direction of the Astronomer Royal, at the Observatory, Greenwich, show the variation may amount to four hundred per cent., as in the chronometer, without altering the time. In mentioning this, however, it is due to Professor Cowper, Mr. C. Frodsham, and the other gentlemen who supported the old notion, that your readers should be reminded of the discussion at the Society of Arts having taken place some months before these experiments had been published.

I might go on to direct attention to those points which most conduce to the accuracy of timekeepers, if it were not forestalling a paper that I have prepared to read before the Society of Arts next session, all the evenings of the present session being already engaged.

I am, Sir, yours, &c.,

E. T. LOSEBY.

London, May 19, 1852.

SOCIAL EFFECTS OF THE MANUFACTURING SYSTEM.

There are some persons who affect to lament over the loss of domestic comfort, simple manners, and social happiness, which they say our manufacturing system has caused. And they delight to draw a glowing picture of the time when, amidst the quiet scenes of Nature, far from the smoky town or the clatter of machinery, the spinner and the weaver followed their honest calling in the bosom of their families; not wasted in their physical strength by e cessive toil, nor ground down to the dust by the rapacity of tyrannical masters, but earn ing a comfortable competency by moderate labour:—not a turbulent infidel and Chartist, but a contented, religious, and loyal peasantry. Such a picture is a fable, not a fact. There can be no question, from all the records and traditions of the trade, that the physical comforts of the artisan have been vastly increased, and his social position greatly elevated. In 1787, the average rate of the wages paid in the worsted trade in fifteen counties was 3s. 3d. per week. I have heard the testimony of old men, that, a little later, 5s. a week for a weaver was accounted a great accomplishment. And this, be it remembered, when a stone of flour weighing 16 lbs. cost the working man from 3s. to 3s. 6d. At the present time, with flour at 2s. per stone, with other articles of provision reduced in proportion with articles of clothing one-third at least of their former price, the average wages at Bradford, of all factory workers, men, women, and children, is 10s. per week. Nor is the amelioration in their social condition less real. I know, indeed, that there is still room for sanitary, for educational, for religious improvement; for ventilation and smoke consumption, for the clearing away of crowded alleys, the opening of parks, museums, and libraries, the letting in the light of heaven, literally and spiritually on dark and benighted dwellings. I say not that there are no grasping masters—men ignorant or regardless of their high moral obligations. But I do say that these are the exception, not the rule: that we have amongst us many noble "Captains of industry," between whom and their workpeople there is some other connection than a mere money payment, who study to promote their welfare and elevation, and whose efforts are met with a frank confidence and a grateful recognition: and I could take you to thousands of homes in the West Riding, where not only honest labour meets with its due pecuniary reward, but where comfort, cleanliness, and intelligence prevail;—homes radiant with happiness, and many of them hallowed by religion. It has been tauntingly said, that English manufacturers regard it as their great and only mission to produce cloth at a fraction below the rest of the world. I may be permitted to make use of an expression employed by a great statesman, and say that to-night I am proud to stand by my order; that we do accept it as our mission to provide clothing for the world; and that in thus making nature minister to physical comfort, we are promoting peace and extending civilization, and working out the designs of a Divine and Beneficent Provi-

dence. If we are doing this consciously with high aims and noble purposes, with a deep sense of our duty, and a sincere effort to discharge it, we shall pursue industry in the same spirit in which Lord Bacon teaches us to study philosophy, "for the glory of God and the good of man's estate."—*Lecture by Mr. Forbes. Soc. of Arts.*

FILTER TAP.

(Registered under the Act for the Protection of Articles of Utility. Walter James Handcombe Rudd and Company, of 23, Little Newport-street, Leicester-square, Proprietors.)

Description.

The above figure represents a longitudinal section of this filter tap. AA is the exterior casing of the filter, which is attached to the cistern or source of supply, by a screw joint at *a*. In the interior of the casing are placed tubes, B and C, which are arranged so as to give to the liquid passing through the filter a circuitous course from the cistern at *a*, to the tap D. The tube B has a partition at *b*, and is perforated with numerous holes in that part of its length, between the partition and the inlet entrance, and it is through these perforations that the liquid passes. The tube C has also a perforated partition at *c*, composed of some porous filtering material, and the interstices between the tubes B and C, as well as the interior of the tube C, are filled with a suitable filtering medium. The course taken by the liquid in passing through the filter is indicated by the arrows.

BOTHWAY'S INTERNAL IRON-STRAPPED WOOD BLOCKS.

(Registered under the Act for the Protection of Articles of Utility.)

The fitting of ship blocks with wrought iron straps "*internally*," in lieu of the defective method of iron binding generally adopted, has been experimentally tested with the greatest success. The whole strain to which the block is exposed, on the improved principle, acts upon the grain or fibre of the iron longitudinally, without any torsion whatever, and consequently the shiver pin must be severed before the block is crippled. The shiver pin is protected by metallic bearings brought much nearer together than in blocks bound in the common method, as each wooden division of the block, whether it be of single, double, or treble construction, has its own iron strap, and each strap is pierced at its centre to receive the shiver pin, so that there is no possibility of the latter becoming deflected. In the ordinary mode of binding, the iron strapping is first heated to a red heat; it is then bent round the block, and immediately afterwards immersed in cold water: in the first place, to prevent the burning or charring of the block; and in the second, to shrink or contract the metal round the shell, to make what is

termed a snug fit. The result is an inevitable injury to the fibrous structure of the metal by the sudden change of temperature thus induced, and the binding accordingly gives way at the weakest point, either on the shoulders of the block, or at the foot or root of the hook.

The merits of the invention have been strikingly exhibited by experiments which have from time to time been made in the different dockyards.

A proof of their superior strength was obtained from the following trials made in Her Majesty's Dockyard, Devonport, in March, 1847, in the presence of Admiral Sir John Louis, Bart., and the principal officers, naval gentlemen, ship-owners, &c.

Two 20-inch wood blocks having been made (one of each description), were fastened with chains to two pollards shored up for the occasion, a seven and a half inch rope was rove in the blocks, and each end of the rope brought to the two capstans, having forty-five men to each capstan; when at the full strength of ninety men at the two capstans, the iron binding of the ordinary block drew off from the head of it, and broke, and the shiver pin bent into the divi- Government block totally unserviceable, and sions seven-eighths of an inch, rendering the leaving Bothway's block unhurt, thereby giving the most convincing and satisfactory proof of the superiority of his block and straps.

The breaking strains of Bothway's and the Government blocks, as ascertained by experiments made on them at the testing machines of Her Majesty's Dockyards at Portsmouth and Woolwich were as follows:

Description of Block.	Size.	Strain applied.				Result.
		Tons.	Cwt.	qrs.	lbs.	
Government..........	7-inch Single	2	14	1	1	Block broke.
Bothway's...........	7-inch Single	11	15	0	0	Straps bent.

The iron straps of Bothway's 7-inch block weighed only 2 lbs., yet such was their strength, that iron shackles were obliged to be substituted for rope in making the experiment; and the 5-8ths shiver pin was cut through, as if done with a cold chisel.

In October last, a most important experiment was made in Devonport Dockyard, by the permission of the Lords of the Admiralty, to try the exact breaking strain of a 26-inch cat block, made on purpose, in the Dockyard, against a 20-inch cat of Bothway's. The result completely confirms the superiority of the latter, as the following Table will illustrate:

TABLE.—*Showing the comparative strength of Government and Bothway's Blocks, from experiment made in H. M. Dockyard, at Devonport, October*, 1848.

Description of Block.	Weight of Block, with Hook, &c., complete.	Amount of the Strain applied.	Result of the Strain on the Block.
26-inch iron-bound Government Block	cwt. qrs. lbs. 6 1 18	27 Tons.	The shiver-pin bent 5-8 inch, and shivers brought hard down on the arse, preventing further deflection of the pin or use of the Block.
20-inch iron-bound Government Block.	cwt. qrs. lbs. 2 3 17	21 Tons.	Block gave way, and shiver-pint bent.
20-inch Bothway's internal Strap Block.	cwt. qrs. lbs. 2 1 0	50½ Tons.	BLOCK UNHURT, *Rope Broken.*

A great disproportion appears in the weight of the ironwork of the two Government blocks, which may, perhaps, be accounted for thus:—The 26-inch was *expressly* bound for this experiment; the 20-inch was drawn from store.

The other advantages connected with the internal strap blocks are numerous; combining great neatness of appearance with vastly augmented power, they are capable of carrying indifferently, as the necessity of the moment may require, either a shackle, a swivel, or a standing-hook. *Rope strapping and iron binding is altogether superseded, and a great diminution of top-weight achieved.*

These blocks have been in constant use two years on board Her Majesty's Revenue cutter *Arrow* for peak and main-haulyard blocks, and have been very favourably reported on by the commander, and ordered to be adopted. An idea of the saving of top-weight by the use of these blocks on board the *Arrow* may be formed from the following:

	lbs.
Weight of six of Bothway's 6½-inch blocks	41½
Weight of six of old 9-inch iron-bound blocks, previously in use..	75
Difference in favour of Bothway's blocks, on six blocks only. ..	33½

They possess also this very peculiar advantage, that if the wood part decays or is damaged, they can be rebuilt to the same old iron-work with very little trouble, or without the assistance of a forge. In this respect they are more important for the service of the Royal Navy, as from the extensive stores of blocks usually kept in our Dockyards, both at home and abroad, thousands perish by rot and otherwise before they are ever drawn from the stores for use, and consequently cause an immense loss to the service.

Another strong testimony in favour of the principle of construction, and consequent strength and durability of Bothway's arrangement of the iron-work in blocks exposed to extraordinary strain, is afforded by the following extract from a letter from William Glennie, Esq., Resident Engineer at the Saltash Works, now in execution by the Cornwall Railway Company:

Cornwall Railway, Engineer's-office,
Plymouth, 15th May, 1849.

Sir,—I am happy to inform you, that your Internal Iron Strapped Blocks, which you supplied to the Works of this Railway at Saltash, have proved most efficient, and notwithstanding the very severe trial that they have had, they have not been injured in the slightest degree.

As they only formed a part of the purchase used for lifting the iron cylinder, I cannot tell you what weight they lifted. The cylinder, with the pump fixed within it, weighed about 30 tons, and it was sometimes 16 to 17 feet deep in the mud when we had to lift it. The fall used was a 7-8ths of an inch chain, wound upon a drum 3 feet in diameter and worked by a 6-horse power steam engine, and the mud was so tenacious, that often we were unable to lift the cylinder with the engine power, and were obliged to heave taught at low water, and allow the tide to lift it out of the mud. Now the purchase consisted of six sheaves at the sheer head, and six on the cylinder,—your threefold Block forming three of those at the sheer head. This will give you some idea of the strain to which it must have been subjected. In the course of our operations we lifted the cylinder out of the mud thirty-five times, and when the purchase was taken down, no defect whatever could be discovered in your block. The other blocks used were entirely of metal. Size of blocks 24 inches.

Your single blocks were most serviceable to us as leading blocks, and much time and labour were saved by the use of iron shackles—their size 16 in.

I am, Sir, your obedient Servant,

William Glennie,
Resident Engineer.

RAILROAD LAW IN THE UNITED STATES.

Railroad companies are pretty severely dealt with sometimes, and this we think has been the case with the New Jersey Railroad Company in a recent case, where a person named Kennard brought an action against the said Company for damages, he having got his arm broken by having it extended out of the window of a car while passing over a bridge. It appears that the plaintiff, Mr. Kennard, whilst passing over the bridge on the road of the Company, sitting with his back to the engine, with his arm out of the window, had it broken above the elbow by coming in contact with some portion of the bridge. The bridge, it was shown, was of the ordinary width, and the Company, in their defence, insisted upon the duty of passengers, when the train was in motion, keeping their arms inside, and not outside the cars; that if this had been done, no injury would have been sustained by Mr. Kennard.

The Judge (Gibson) in his charge to the jury, asserted as law some points which may compel railroad companies to adopt measures very annoying and inconvenient to the travelling community. The learned Judge decided that the notice in regard to keeping the arms and heads of passengers inside the cars, and all such notices, are good for nothing—that a railroad company is liable for damages, even in the event of their rules and notices being disregarded by passengers, because some may not see them, and some cannot see them, and some cannot understand the language in which they are written.

The Jury returned a verdict of 2,500 dollars.

The *Boston Railway Times* has some very appropriate remarks upon the subject. It

considers the charge of the Judge and the verdict rendered the reverse of common sense. Although we have thought that many of our railroad bridges were too narrow, we never could blame a company for a passenger getting his arm broke by disobeying the positive rules "do not look out of the windows."—Unless passengers obey the railroad rules of safety, how can the Company take care of their lives and prevent accidents? In France they used to lock the doors to prevent accidents, and at one time a car took fire and many people were consumed because they could not force the doors. Judge Gibson, we presume, would be the last man to allow railroad companies to put chains around their passengers to keep them from moving, or to charge a jury to return a verdict against a railroad company because some *non compos mentis* person jumped out of a window when the cars were running at a high speed, and yet the above charge looks as if he would.

If we take a view of the case from another point, however, we may be ready to accord justice to the charge of the Judge and righteousness to the verdict of the Jury. Who has travelled by a railroad, in summer, along with a number of children, and not trembled oftentimes for their safety by the insecurity of the windows? Wire screens or stancheons should be placed inside or outside of railroad car-windows.—*Scientific American.*

PHOTOGRAPHIC PORTRAITS.

[The following remarkable correspondence has appeared in the *Times*.]

SIR,—I observe in the *Times* that M. Claudet, in the character of the oldest photographer, and therefore, probably, the most prejudiced, has taken it very much amiss that the public has learned the fact that photographic portraits taken by lenses deviate greatly, and more and more, from truth as the lenses increase in diameter. I took the earliest opportunity of communicating this new and important fact to my photographic friends, Messrs. Ross and Thomson, photographers to the Queen, in Edinburgh; to Mr. Kilburn, photographer to the Queen, in London; and to Mr. Henneman and Mr. Horne, who have produced such beautiful portraits, the one on paper and the other with collodion on glass. All these gentlemen received the information as a valuable contribution to the art which they so skilfully practise,—as an explanation, too, of the well-known imperfection of photographic portraits, and as a stimulus to remove it by using small lenses, and searching for more sensitive materials. They did not, like M. Claudet, consider the announcement of a scientific truth as an invasion of their pecuniary interests; and while he, on the authority of his experiments, will continue to practise his art as he has hitherto done, with larger lenses; they, and we trust many others, will not disdain to guide the light of the sun by the light of science, and thus diminish the number of those grim anamorphoses of humanity which proceed from no studio more copiously than those of M. Claudet, and which, though a terror to the domestic circle, have the merit of showing us how we shall look in a winding-sheet, or under the more ghastly phase of a *post-mortem* examination.

If you, Sir, or any of your readers, will take the trouble of looking into an article "Binocular Vision and the Stereoscope," * in the Number of the *North British Review* just published, you will form a better opinion on the subject under discussion, and will see it demonstrated that the method employed by M. Claudet of taking binocular portraits, to be raised into relief by the stereoscope, *is not only utterly erroneous in principle, and incapable of giving a correct representation of the human form*, but that it actually involves the very optical truth which he professionally repudiates.

I am, Sir, yours most truly,
D. BREWSTER.

Athenæum, May 12.

Sir,—The letter of Sir David Brewster in the *Times* speaks of me as "the oldest photographer, and, therefore, probably the most prejudiced." Is this worthy of a man of science, himself well advanced in the vale of years, and much more open than I am to such an observation? Sir David reiterates his alleged discovery, stating that I oppose it as an invasion of my pecuniary interests. I have no "pecuniary interests," except in

* The ordinary daguerreotype presents, as is well known, a mere flat miniature of the person represented. It is a common perspective pencilling, effected by the sun's rays, and no more. In the stereoscope two distinct copies of the same image are simultaneously taken in two adjacent cameras. Though these are apparently similar, they are yet, in fact, somewhat different in their representation of the object, corresponding as nearly as possible to the slight difference of picture produced in Nature upon the right and left eyes of an observer, in viewing any solid figure. The two daguerreotypes so taken are placed in a peculiarly-constructed box, termed a stereoscope, which admits a view of one picture to the right eye only, and of the other to the left. The consequence is, that the two images are so completely blended by the operation of the brain, that the sense of sight no longer recognizes a flat picture, but a solid reality (in miniature it is true), but otherwise endowed with all the appearance of life, excepting that of motion.—ED. M. M.

practising daguerreotype in the best possible manner, and my denial of the invention now claimed by Sir David, is simply a statement that his theory is not borne out by my experiments, which prove that perfect lenses of 3¼ aperture of a sufficiently long focus, operating at a distance of 10 or 12 feet, are capable of giving a correct representation of the human form and producing binocular portraits, to be raised into relief by the stereoscope in all the conditions requisite for their coalescing without appearance of exaggeration. As I cannot enter here into the enumeration of my experiments, I am ready to repeat them before any scientific persons interested in the question.

I ask Sir David to reconsider the following expressions which he has applied to me, and to the art which I pursue, with equal injustice to both. He speaks of "those grim anamorphoses of humanity which proceed from no studio more copiously than those of M. Claudet, and which, though a terror to the domestic circle, have the merit of showing us how we shall look in a winding-sheet or under the more ghastly phase of a *post mortem* examination." If this be true, Sir David has taken a great and lively interest in ascertaining how he shall look under the painful circumstances described, as I have had the honour of taking his portrait many times, and on the last occasion about six weeks ago. Nor has he always been so disgusted with the result as he now all of a sudden appears to be. In the *North British Review*, August, 1847, I find the following among many allusions to my name:—"The art of taking portraits has been particularly studied and brought to a high degree of perfection by M. A. Claudet, who was the first person who discovered in May, 1841, an easy and sure method of accelerating the action of light, and thus greatly shortening the process. M. Claudet's long experience in the art of daguerreotyping has enabled him to produce portraits of great beauty and force," &c.

Sir David has thought it consistent with his eminent position as a man of science, to strike a blow, through your columns, at my professional reputation. Through the same medium of publicity, I venture to ask, how, if I am so inferior and "prejudiced a photographer," the Jury in Class X. of the Great Exhibition (Sir David being a member), awarded to me the only Council medal for daguerreotypes?

I have the honour to be Sir, your most obedient Servant,

A. CLAUDET.

107, Regent-street, May 15.

THE "QUEEN OF THE SOUTH" STEAMER.

An experimental trip took place down the river on Saturday last, for the purpose of testing a newly-launched vessel, the *Queen of the South*, belonging to the General Screw Steam Company. She is a noble specimen of naval architecture, well calculated to excite the utmost confidence, and in accommodation for passengers and her engine arrangements especially worthy of commendation Ventilation is carried out with a degree of success almost unprecedented. As to the engines, it must be considered sufficient to say that they were manufactured by the Messrs. Maudslay; and that they combine in an unprecedented degree economy of space with efficiency of action; the most perfect form of marine action, that which in simplicity most nearly approaches to direct action, has been developed by the screw propeller. Two or three points with reference to the machinery of the *Queen of the South* may be worth mentioning. In the first place, it occupies only one-third of the space of paddle engines. Again, a new construction of air-pump has been secured which possesses many advantages. Then the bilge-pump has been so arranged that an attack of pirates, for example, may be repelled with scalding water from the boilers. The vessel is built of iron, with watertight compartments, by the eminent builders the Messrs. Mare. She measures 240 feet from stem to stern, 39 feet beam, 25 feet in depth of hold. She is of 1,850 tons burden, and is furnished with engines of 300 horse power. The screw works 60 revolutions a minute, and the blades of it are so arranged that they can be thrown on a line with the keel, so as not to impede the sailing of the ship. The *Queen* steamed down to the Nore, achieving a speed of 10½ knots an hour.—*Times*.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MAY 19, 1852.

WILLIAM SINCLAIR, of Manchester. *For certain improvements in locks*. Patent dated November 13, 1851.

The present improvements have relation to "tumbler locks," and consist—

1. In combining the action of two or more of the tumblers of a lock in such manner that they shall be individually incapable of being brought to the position requisite for the admission of the locking ring, pin, or plate, or in such manner, that the movement of any one of the tumblers shall produce upon the others a locking effect, which would prevent their being moved.

2. In combining with wards or escutcheons a revolving shield or plate, which will have the effect of preventing the introduction of, or increasing the difficulty of, introducing picking instruments.

3. In the employment of a serpentine or zigzag gate or way, for the introduction of the locking pin, and in the application of a compound motion to the tumblers, the effect of which is, that by once turning round the key a double or triple locking may be produced.

4. In the adaptation of a dial or indicator to tumbler locks, whereby the changes of the tumbler may be varied according to the permutations of a moveable bit key, or whereby, in combination with other apparatus, the positions of the parts of the lock may be so arranged after the act of locking, as to prevent the possibility of the lock being opened, even with the legitimate key, without the knowledge of the secret arrangement.

5. In dispensing with shackle and eyebolt of padlocks, or either of them, and in causing the bolt of the lock to be held, and the locking effected by means of pins or projections on, or holes, or recesses formed in a plate of metal to which the lock is attached.

Hugh Bowlsby Willson, of the York Hotel, Blackfriars, gentleman. *For improvements in the construction of rails for railways.* (A communication.) Patent dated November 13, 1851.

These improvements consist in constructing the rails for railways in two parts, which are fitted with recesses and projections, so that when laid together longitudinally, so as to break joint, and the two parts secured to each other by bolts or rivets, they shall constitute a rail possessing in a great measure the firmness and elasticity of a continuous bar of iron. This principle of construction may be applied to rails of various kinds, and by making the base of the compound rail sufficiently wide, the use of chairs may be dispensed with, the rails being laid on transverse wooden sleepers, and secured thereto by hook-headed pins or clamps. The rails may be also made hollow, and thus a great width of base obtained in proportion to the weight of metal employed. A modification of this mode of construction consists in forming the interior faces or meeting parts of two sections of a rail with grooves, into which square filling pieces of metal are introduced at those points where the half rails are bolted together; the bolts passing through the filling pieces.

Double headed rails, solid or hollow, may be also constructed in the manner described. These rails, of course, would require chairs for their support, and when worn on one face may be turned over in the same way as the common double-headed rails, so as to present a new surface to the action of the rolling stock.

Claim.—The construction of compound break-joint rails for railways described.

George Sheppard, of Stuckton Ironworks, Fordingbridge, Hants, engineer. *For improvements in the construction of apparatus for grinding grain and other substances.* Patent dated November 13, 1851.

The first part of this invention consists in combining with mill-stones apparatus for withdrawing from the meal, or other manufactured product, the portion of air introduced or drawn in between the stones by the grain to be ground, for ventilating the stones or keeping them cool; the object being to prevent the inconveniences which result when the air is withdrawn from a receiver into which it passes at the same time with the ground meal coming from the stones. This the patentee effects by inclosing the mill-stones in an air-tight casing, to which he provides two outlets or pipes, one above for drawing off the air, and another below to admit of the meal or flour passing away to a suitable receiver. When more than one pair of stones is employed, the air outlet pipes are connected to a main trunk, which trunk is placed in communication with an exhausting fan, by which the air is drawn out from all the pairs of stones simultaneously. The grain is fed in the usual way by an eye in the runner, and in order to facilitate the expulsion of the meal, a series of wings or scrapers are attached to the periphery of the runner by which the meal is collected and driven round to the exit provided for it.

The second part of the invention consists in constructing millstones of a series of segmentally shaped burrs which are bound together by a hoop, so as to form a stone of any required size. Millstones constructed in this way are said to be more durable than those composed of a single piece of burr-stone.

Claims.—1. The means described of separating the air which is drawn in between the grinding surfaces for ventilating the stones, or keeping them cool, from the meal, or other manufactured product, and of delivering such product into a suitable receiver without the waste and inconvenience hitherto resulting from the use of a current of air for ventilating the grinding surfaces.

2. The construction of mill-stones, as described.

William Smith, of Derby, William Dickinson, of Derby, and Thomas Peake, also of Derby. *For certain improvements in the manufacture of chenille and other piled fabrics.* Patent dated Nov. 13, 1851.

The patentees describe and claim an arrangement of machinery for the purposes of their invention, in which the shoot or pile, which is delivered from a revolving shuttle above, is cut at the time of its being bound in by the binding threads, by means of revolving cutters or discs fixed on a roller, and revolving in contact with a second roller, in which is a groove for the binding threads. The cutters are mounted in a moveable frame, to admit of their being readily removed and replaced by others when chenilles of different widths are required to be produced. By multiplying the number of cutters, and regulating the distance between them, an indefinite number of pieces of chenilles may be produced simultaneously, the cutters separating the shoot or pile into shreds of a length suitable to the width of article to be manufactured.

JULIAN BERNARD, of Green-street, Grosvenor-square, gentleman. *For improvements in the manufacture of leather or dressed skins, and of materials to be used in lieu thereof, and in the machinery or apparatus to be employed in such manufacture.* Patent dated November 13, 1851.

Claims.—1. A system or mode of graining or ornamenting leather or dressed skins by the use of an original morocco or other skin as the matrix for the production of the pressing die, in combination with an elastic pressing medium.

2. The application and use of the electrotype process for the production of a grained or figured pressing die for ornamenting leather or dressed skins, to be used in combination with an elastic pressing medium.

3. The application and use of caoutchouc or India-rubber surfaces in ornamenting or graining leather or dressed skins.

4. A system or mode of graining or ornamenting leather or dressed skins by pressure.

5. A system or mode of splitting or shaving leather or skins.

6. The application and use of atmospheric pressure for holding down the material to be cut, shaved, or split.

7. The employment and use of a porous or permeable table or shaving surface in shaving or splitting leather.

8. A system or mode of working or actuating the splitting or shaving knife by a parallel movement.

9. A system or mode of grinding or sharpening the knives of splitting or shaving machines.

10. The application and use in ordinary roller splitting machines of a roller surface of India-rubber to support the material to be cut.

11. The employment and use of what the patentee terms his "Compound Union Leather."

12. A system or mode of producing a compound fabric, as a substitute for ordinary leather, by the junction of a woven or felted fabric with one or more layers of skins.

13. The employment and use of a compound or union fabric composed of leather or dressed skin and woven or felted fabrics.

14. A system or mode of adding strength to inferior, thin, or split skins by joining them to a woven or felted fabric.

15. A system or mode of producing a compound fabric of superior strength by the junction of distinct woven fabrics, with their respective warp threads crossing each other, or by the junction of distinct fabrics originally manufactured on this principle.

16. A system or mode of diceing or ornamenting leather or dressed skins.

17. A system or mode of producing an elastic diceing or marking pressure.

18. The application of circular disc markers for diceing or marking leather and dressed skins.

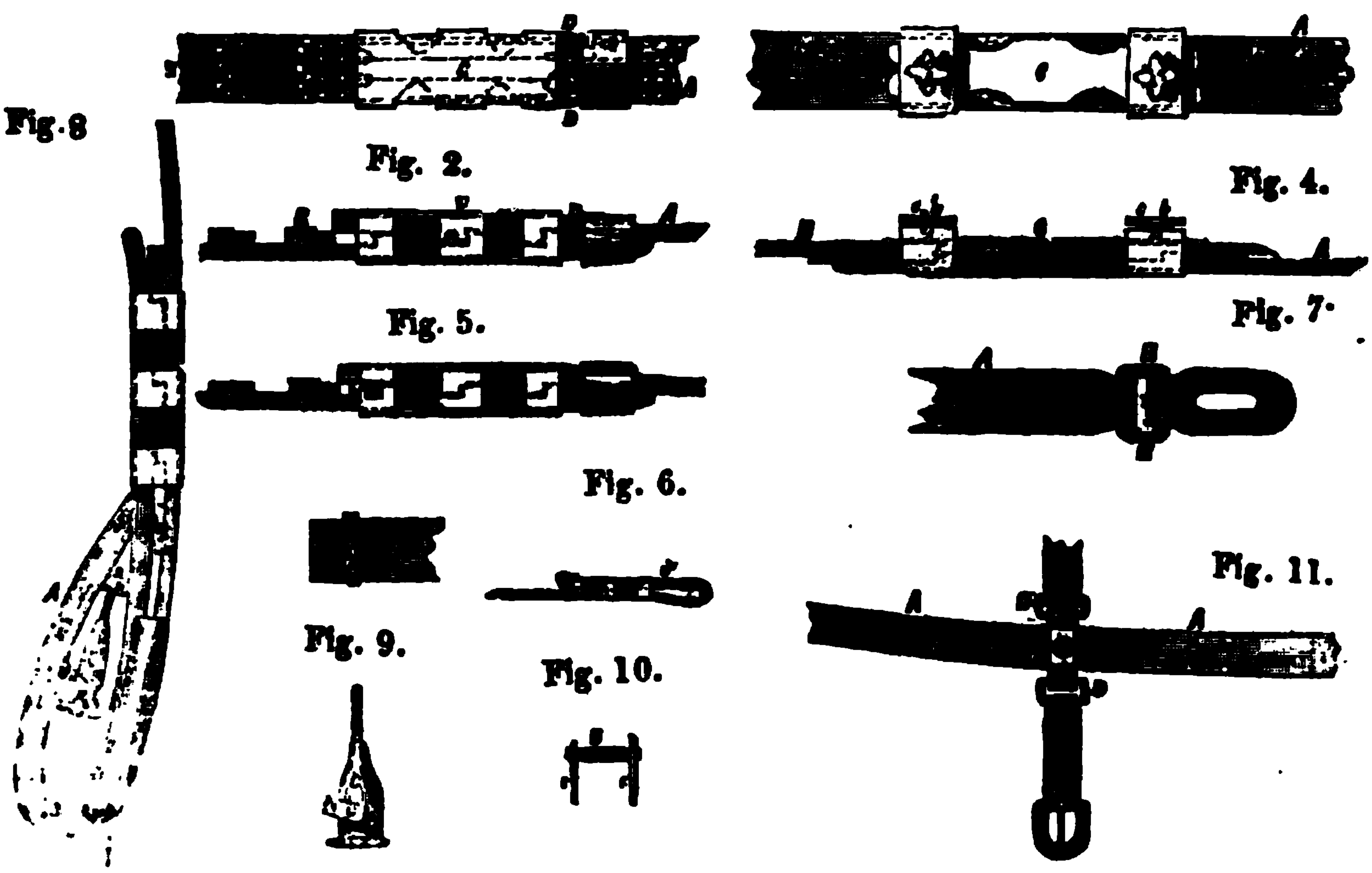
JAMES LOTT, of Whitchurch, Hants, saddler. *For improvements in harness and fastenings.* Patent dated November 15, 1851.

Specification.

Firstly. My invention consists of an improved fastening, which I propose to employ as a substitute for the buckle ordinarily used for forming connections between parts of harness, and for tightening and loosening the same; and, generally speaking, in most cases where buckles have been and are adopted.

Fig. 1 is a side, and fig. 2 an edge view of the said improved fastening as applied to a trace. A is one of the two portions of the trace to be connected together, and B the other portion, or draught end of the trace. The parts A and B are fitted on their inner sides with rectangular projections or stops, *aa*, placed at distances apart, corresponding exactly to the length or width of the projections, so that when the two portions of the trace are brought together, the projections on the one portion shall fit into the spaces between the projections on the other portion. In order to enable them the better to resist the strain to which they are subjected, I make these projections or stops of metal or some other hard unyielding material, or I protect their edges when composed of leather with an angle piece of metal. C is a slide or holder by which the ends of the trace when brought together, as above mentioned, are held securely and prevented from becoming disengaged. D is a spring catch for retaining the slide or holder C in its place.

When it is desired to tighten or slacken the connection of the two ends of the trace, it is only necessary to pass the slide clear of the two meeting ends, and to shift either end of the trace in the required direction, after which the two portions are pressed together, and the slide brought over them, when a secure fastening is effected. A fastening of this sort will be obviously much more capable of resisting strain than the buckles ordinarily used, because, instead of being weakened by piercing holes through the parts to be connected, to receive the tongue or tongues of the buckle, the trace is absolutely strengthened by the attachment of the stop-pieces, and the facility of fastening and unfastening the parts is, at the same time, rather increased than diminished.



Figs. 3 and 4 show a modification of the fastening just described, in which screws are used to retain the slide or holder in its place. A and B are the two ends of the trace or other part of the harness to be connected together. *aa* are the stop-pieces or projections; C the slide or holder; and *bb* screws by which the holder is retained in its proper position over the connected ends of the trace. By turning the screws, the holder or slide is readily moved when it is desired to tighten or slacken the connection. And the screws are prevented from turning, except when the trace is required to be adjusted by means of pins, *cc*, which pass through the heads of the screws, and take into sockets in the side of the holder.

Figs. 5 and 6 are edge views of two modifications of the fastening firstly before described, which differ only from it in the method adopted of holding the slide from slipping. In fig. 5 this is effected by means of a spring *d* attached to the shifting end of the trace or other part of harness to be connected. The ends of the spring *d* take into slots *e* formed in both sides of one end of the slide, and hold it securely. When the slide is to be moved, the spring is pressed out of the slots *e*, after which the slide can be passed freely off the two parts of the trace. In fig. 6 the slide is held in its place by means of a projection *f*, and hook *g*, formed on the shifting end of the strap. The slide or holder I generally construct of metal, plain or ornamented; but it may also be made of metal covered with leather. Other means than those above mentioned may also be adopted for holding the slide in its place.

Secondly. My invention consists in fitting to the end of a trace a joint or swivel, by which I am enabled to dispense with the usual cock-eye. Fig. 7 shows this part of my invention. A is the end of the trace; B the joint; the part C is composed of metal covered with leather, and turns freely on the joint B.

Thirdly. My invention consists of an improved shaft tug stop. Fig. 8 is a side view of this tug stop; A is the sling formed in the end of the back-band for supporting the shaft; B is a piece of metal in the upper part of the sling, which has a female screw formed in its centre, to receive the screwed

end of the tug stop C. By turning the tug stop, it will be raised or lowered in the sling to suit the size of the shaft, and keep it from jerking. *a* is a catch attached to the tug stop, and *b* is a slot or recess formed in the side of the sling to receive the catch *a*, and prevent the tug stop from turning or becoming disengaged after it has been adjusted to the shaft in the sling. By releasing the catch from the slot, the tug stop can be readily turned, and its hold on the shaft tightened or relaxed at pleasure. Fig. 9 shows the tug stop detached, and fig. 10 shows the piece of metal B with the screw tapped in it for the reception of the end of the tug stop. The parts *c c* are attached to the ends of the piece B, to provide for its being fixed to the interior of the sling, which is done by first introducing the parts *c c* between the two thicknesses of leather, of which the sling of the back-band is composed, and then sewing around the edges, so as to secure the piece B in its proper position. The piece B is capable of being turned so as to bring it to a more convenient position for introducing the screwed end of the tug stop C.

Fourthly. My invention consists of an improved dee-piece (as it is technically termed), which is represented in fig. 11. A is the trace or strap on which the dee-piece slides; B is the dee, formed of metal, having a slit through which to pass the trace or strap; C is a screw for fixing the dee-piece in any required position on the trace. D D are swivels attached to each end of the dee-piece, for fastening straps or bands so as may be required.

And having now described the nature of my said invention, and in what manner the same is to be performed, I declare that I claim as of my invention the several improvements in harness and fastenings represented in figs. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11, before described, each in the peculiar feature of construction by which it is distinguished from all others heretofore known or in use.

Charles Ewing, of Bodorgan, Anglesea, steward and gardener. *For an improved method or methods of construction applicable to architectural and horticultural purpose.* Patent dated November 15, 1851.

This invention consists of an improved method or methods of constructing the walls of gardens and other horticultural structures, whereby there is obtained for the plants or fruit trees grown thereunder, thereon, or therein, all the protection afforded by a close green-house combined with that free exposure to solar light and heat which is essential to the perfect maturation of flowers and fruit; and thus the production of crops is insured without reference to the variableness of climate.

This method or methods of construction are distinguishable from all others in two principal particulars, *first*, in the materials used being transparent, as glass, combined or held together by metallic or wooden framework, or in part only transparent, and in part opaque; and, *second*, in the wall or other structure being in every case made hollow, and interiorly accessible more or less from the outside.

According to the first described method of construction, the walls are composed of two sets of sliding sashes fitted with panes or plates of glass, which sashes rest upon a grooved bar of iron, which is supported by rollers in a framework of wood or metal resting on blocks of stone or concrete sunk in the ground, so as to prevent access of air to the interior of the wall, except when the sashes are opened, which is done by sliding them in either direction. The top lights of the wall may be either flat or of an arched, or other suitable form, and made to open by one portion being slid under the next adjoining it. When flat, they may be composed of a single glass plate set in a frame, hinged to one side of the general framework, and provided with a cord and pulley for raising and lowering the same. Or they may be formed by two plates hinged to the opposite sides of the framework, and each provided with a cord and pulley, so that they may each be raised independent of the other. For the support of the plants or fruit trees grown under these improved glass walls, a double wire trellis is carried along the centre of the space between the two sets of sashes constituting the wall, and the trees are trained on each side of the same. Panels of slate, wood, or tile, can be let in between the double trellis to produce a reflection of heat on the plants. The upright supports of the trellis would in this case require to be provided with grooves to receive the panels. Or the trellis may be attached to the uprights of the framework in such manner as to leave a space in the centre of the wall wide enough to admit a person to walk or pass between them.

It will be seen that, in addition to the advantages above mentioned, which are obtained by the use of these hollow glass walls, their transparency does not at all hinder the passage through them of solar heat; and, consequently, the growth of plants or trees contained in them will be little affected by the local aspect of the wall; those which face the north receiving almost as great an amount of warmth as those which face the south. And when the wall runs north and south, the plants or trees grown therein will

receive the full benefit of the sun's heat during the entire day, and no shade will be produced, as must invariably be the case with stone walls. The appearance of the glass walls, too, is highly ornamental, and they may with propriety be used where a non-transparent wall would be objectionable.

Boundary walls may be also constructed in the same manner, one side only being furnished with slides or sashes (for which doors opening outwards may be substituted). The fixed side of the wall may be composed of plates or panes of glass set in a suitable framework, or it may be constructed of slate, wood, tile, or metallic panels, having two trellises, one for training trees against the outside of the non-transparent side of the wall, and the other for the trees grown in the hollow of the wall.

Another method of construction consists in forming one or both sides of the wall of a series of doors opening outwards, instead of employing sliding sashes, as before described. By this means, the whole of the tree contained in the wall may be exposed to the unobstructed heat of the sun, whilst increased facility of access is obtained from the outside. In this case also the sides of the wall may be placed at a sufficient distance apart to allow a person to pass along between them. By connecting each of the doors by means of a cord, with a spindle running inside along the whole length of the wall, and, turning this spindle by a winch-handle attached to the end of it, the whole of the doors of one side of a wall may be readily opened and closed simultaneously.

The patentee describes also modifications of his system of construction, in which the walls are partly composed of glass or other transparent materials and partly of opaque materials, as brick, slate, or zinc. The glass front of the walls may be composed either of sliding sashes or doors, as described, and the toplights may be made to open by lifting, or by one portion being slid over another.

In some cases, the patentee finds it desirable to construct the front of the glass walls with every alternate slide or sash composed of two parts, the lower one of which is hinged to the upper at its upper edge, and opens outwards. The opening is effected by the employment of a circular rack and a pinion gearing into it, by turning which the moveable front is opened to any desired extent, and readily closed.

For the purpose of glazing the slides or sashes, doors, ends, and top-lights of these hollow walls, common sheet glass is employed; but other glass (such as plate glass) either coloured, ground, or plain, may be used.

Claim.—The making of the walls of gardens and other horticultural and architectural structures hollow, and of glass or other transparent material, combined or held together by metallic or wooden framework; or composed in part only of glass or other transparent material, and in part of opaque substances, as brick or slate, as variously exemplified and described.

William Hamer, of Manchester. *For certain improvements in weaving textile fabrics.* Patent dated November 15, 1851.

The nature of these improvements will be readily understood from the claims, which are for—

1. The manufacture of the fabrics known as "Genoa Cord," "Eight-shaft Cord," "Constitution Cord," and "Cable Cord," in which the back is formed by three picks or shoots of weft in each "round" or repeat, combined and interwoven with the warp-threads, as described.

2. The manufacture of the fabric known as "imperial," with seven shoots or picks of weft constituting the round arranged and interwoven with seven warp-threads to the "draft."

SIR SAMUEL BENTHAM'S INVENTION OF THE PARALLEL GUIDE.

In No. 1501 of the *Mechanics' Magazine* the Editor, in a note, page 383, observes that the matter of the invention of the slide-rest wants a little clearing up, and that Mr. Smart referred to one thing, and Professor Willis to another. It may now be stated, on undoubted authority, that the Editor is perfectly correct in his opinion; namely, that Professor Willis's statement belongs to the *sliding-rest*, by which tools are guided in a *turning-lathe* by a screw. But that the *parallel guide* is an appendage to the circular saw-bench, and was truly invented by Sir Samuel Bentham, is distinctly described in his patent of 1793, and has remained in use ever since.

M. S. B.

PARNELL'S SPECIFICATION.

Sir,—In your Magazine, No. 1501, May 12th, page 399, respecting the specification of my patent for certain improvements in locks, I beg respectfully to state you have omitted to say at the end of the third claim —"*when pressure is put upon the bolt*," which is very important to the safety of the lock.

I am, Sir, yours, &c.,
M. Parnell.

32, Little Queen-street,
May 17, 1852.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Samuel Hall, of Manchester, Lancaster, agent, for certain improvements in the construction of cocks, taps, or valves. May 17; six months.

George Frederick Parratt, of Piccadilly, for improvements in life-rafts. May 17; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in the construction of docks, basins, railways, and apparatus connected therewith for raising or removing vessels or ships out of the water, or on to dry land, for the purpose of preserving or repairing the same. (Being a communication.) May 17; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
May 12	3250	G. Thonger	Northampton	Fly catcher.
14	3251	Fowler and Fry	Bristol	Brick die.
,,	3252	G. Walsh	Halifax	Beer-engine suction.
,,	3253	E. Cockey and Son	Frome	Heating boiler.
17	3254	R. W. Savage	St. James's-square	Invisible door-spring.
,,	3255	T. Beckett	Manchester	Spindle gauge.
18	3256	Collins Brothers	Birmingham	Crayon holder.
19	3257	F. Richmond and P. Chandler	Salford	Chaff machine.
,,	3258	Gwest and Chrimes	Rotherham	Water-closet service box.
,,	3259	T. D'Almaine and Co.	Soho-square	Hopper escapement for pianoforte.
20	3260	P. A. L. de Fontainemoreau	Finsbury	Self-indicating altometer.
,,	3261	E. Williams	George-street, Borough	Machine for making rolled balls of boiled sugar.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

May 10	414	Thomas Baylis	Strand	Omnibus-steps.
12	415	G. M. Ford	Portland-road	Valve.
,,	416	E. Cotterill	Birmingham	Letter-box.
,,	417	T. Rooke, jun.	Birmingham	Tubular oil-cloth cover for cornice-poles.
17	418	J. Wright and G. Hannington	Camberwell	Official and corresponding envelope.
19	419	J. Classon	Dublin	Steamboat and railway chess-board and men.
,,	420	J. L. Stevens	Kensington	Flower or shrub-fastener.

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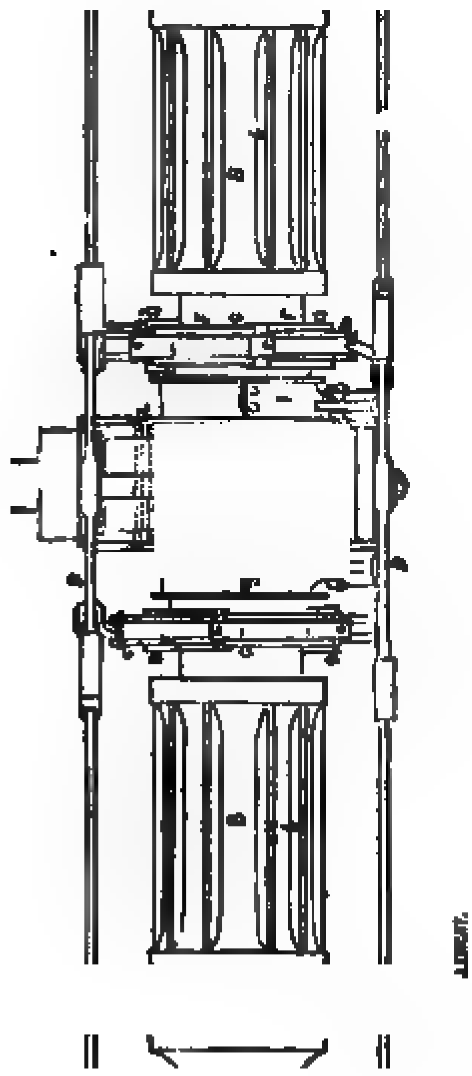
MARYON'S PATENT WINDLASSES.

Fig. 1a.

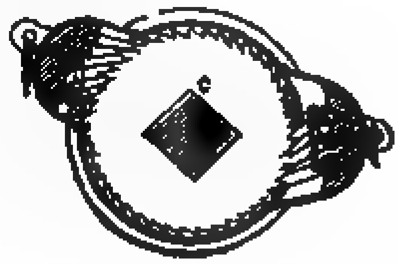


Specification.

FIG. 1 is a longitudinal elevation, and fig. 2 a plan of a double windlass constructed according to my improvements. A, A, A are the standards or headstocks; B B the barrels, which are furnished with whelps *b b*, formed of bar-iron, and pitched at such regular intervals apart as are best suited to the size of chain, for catching the links, and thereby preventing slipping; C C are ratchet-wheels, which are securely fixed to the barrels B B. D D are two oscillating-beams or levers, which are fixed to the headstocks on each side of the windlass, and connected by rods E E to the pawl-boxes F F, so that when the levers are worked up and down the pawl-boxes are moved, the one set of pawls pushing and the other set drawing round the windlass barrel along with them. Fig. 3a and fig. 4a are sections showing the inte-

Fig. 6a.

Fig. 3a.



rior construction of the pawl-boxes. In fig. 3a the pawls are shown in gear with the teeth of the ratchet; in fig. 4a they are shown out of gear. G G are cams by which the pawls can be raised up from the ratchets when it is desired to run out any cable or lower the anchor. H H are the pawls, by which the windlass is prevented from running round and paying off the cable which "has been got," or is wound upon it. I I are two union friction straps, by the aid of which the cable can be given off at any desired degree of velocity, or even stopped from flowing out altoge-

ther. To each of the friction straps there is affixed a short arm *k*, which actuates bent levers L L in such way that when the friction straps are brought into action they lift the pawls H H out of the ratchet on the windlass, and allow it to go free, so as to be entirely under the controlling action of the friction straps for the time being. Fig. 5*a* is a cross section, showing the friction straps, bent lever, and pawls. The bent levers are connected together by a series of bars *a a*, each bar falling immediately under a pawl. When the pressure is again removed from the friction straps the pawls H H fall instantly into their places to stop the windlass. This arrangement admits of a double number of hands conveniently applying their power to the windlass, and of one set of the hands exerting their greatest power while the other set of them are exerting their least power, while the combined action of the friction straps and the windlass pawls H H gives the greatest facility for easing off or altogether stopping the cable.

Fig. 6*a* is a front elevation, fig. 7*a* a plan, and fig. 8*a* a cross section of a single windlass, of nearly similar construction to that just described. A A are the head-stocks; B the windlass barrel; C C the ratchets, which are actuated by the pawls D D—these latter are jointed to the cases E E; F F are sockets formed in the free ends of the cases E E, and into which the handspikes employed for applying the power are "shipped;" the other ends of the cases terminate in eyes or bosses, which take upon the shaft of the windlass. When the handspikes are raised, the pawls freely slide over the teeth of the ratchet, but upon being again pressed down the pawls fall into the ratchets, and bring round the windlass. G is a pawl, which takes into one of the ratchets C C, and prevents the barrel from again returning when the handspikes are raised up. H is the friction strap, which has attached to it a lever I, which serves to raise the pawl G out of the ratchet C when the cable is to be given off. The same application of power which actuates the friction strap thus raises and lowers the holding pawl, as in the windlass shown in fig. 1*a*, and before described.

LORD ROBERT MONTAGU'S TREATISE ON SHIPBUILDING.*

There is undoubted truth in the author's remark, that Naval Architecture has of late obtained an increased amount of general attention, and we believe, too, that it might be added, with equal truth, that this increasing meed of popular favour has proved to many a temptation too strong to be resisted to inundate the press with crude theories destined to enjoy a very shortlived existence. If we class that of Lord Robert Montagu in this category—we hope to be able to convince our readers of the justice of our judgment in the remarks which we are about to offer. We are wholly unacquainted with his Lordship, and can assure him and the world, that if our criticism seem somewhat severe, we are actuated by no sentiment of censoriousness. It would have been more grateful to us to leave his work to fall by its own inevitable tendency into the place which it must eventually occupy without any assistance of ours. As, however, very many into whose hands it is likely to fall, may be influenced by the imposing show of mathematical investigation, which is perhaps remote from their habits of thought, to accept the *new theory* which is quite within their comprehension; we think it our duty, as pioneers to the mechanical public, without fear or favour, to award to the noble author of the work before us a just and impartial meed of criticism; and more especially as it appears from the title-page that a translation of the work into French is meditated; we are unwilling to permit an impression to go abroad among our ingenious neighbours that the principles of Scientific Naval Architects are the principles laid down in Lord Robert Montagu's volume. We coincide with our author's opinion, that progress in the art of naval architecture must be looked for from the combined efforts of *men of science*

* Naval Architecture; a Treatise on Shipbuilding, and the Rig of Clippers, with Suggestions for a new method of laying down Vessels. By Lord Robert Montagu, A.M. London: Colburn and Co., 1852.

and *men of practice*. Many, however, aspire to be classed among the former whom we would exclude,—those, for instance, who think it sufficient to propound their theories in a scientific form, without much care whether they rest on a solid foundation. With the man, for instance, who tells us positively that a parabola is the proper form of midship section, or a *cycloid* of a water line, or of any other section of a vessel, without deigning to offer any other reason for this preference, than that the parabola and cycloid are regular figures, and who then plumes himself on the scientific progress naval architecture has made under his hands we have nothing whatever in common.

The province of the man of science is to examine carefully the *facts* with which the man of practice furnishes him; that he may make them by the true process of induction, the basis of a correct theory, which may serve to guide the constructor of ships in his subsequent plans; to warn him off the shoals and quicksands of error, and pilot him safely, if possible, into the haven of truth. But a theory, however imposing in itself, is utterly worthless unless it *interpret* the facts presented by observation and experience, and for this reason we believe that the true interest of both demand the closest union between the practical and scientific sections of the profession.

It is time, however, that we apply ourselves to our design, which is to dissect the theory propounded in the volume before us. We shall, then, lay before our readers some specimens of the mode in which the *mathematical problems* which the subject presents have been treated.

Our author seems to labour under a mistaken impression, that it is the received opinion among the scientific members of the profession, that the water displaced by vessels in forcing their passage through the deep escapes in the direction of water-lines.

It is true, that few theorists have ventured on any absolute statement as to the direction which the escaping fluid takes; the reason for which is to be sought in the known difficulties which surround the subject: although perhaps Mr. Scott Russell's wave theory may possibly be considered as an exception.

Now, if we could discover beforehand in exactly what lines a vessel would divide the water, one of the greatest difficulties of scientific naval architecture would be removed. We might then endeavour to make those lines as fine and convenient as possible; and it is just this discovery which our author flatters himself that he has made. Lord Rober Montagu persuades himself that the water escapes along lines on the ship's surface, to which he gives the name of Dividing-lines. These are "curves of double curvature, which cut the vertical sections of the ship's surface at right angles." Why they should cut the vertical, rather than any other sections at right angles, we are not informed. The *reasons*, however, why the particles of fluid should take the direction of Dividing-lines are stated to be these, "1st. It is natural to suppose that they will pass along the body of a ship in the same direction as that which any other flat thing would naturally take; as a thin plank, for instance." "2nd. The ship's side gives an impulse to the water, which impulse is normal to the surface of the side at that point; and therefore the plane in which the directions of the impulses from two adjacent points must be contained, must of necessity cut at right angles the surface of the ship's sides between." 3rd. We have "the philosophical principle, that Nature performs every thing with the least effort; and fluids in motion between two points on any surface will take the shortest line on that surface. Now, the Dividing-line is the shortest line that can be drawn on the surface of a vessel from any point on the stem-post to the stern."

Now, what fair analogy can be drawn between a plank and the particles of an impinging fluid? The former may, indeed, be made to pass along the surface in the direction supposed; nor would it be difficult to make it take other directions; but from the rigid connection of its parts, the motion of each particle is necessarily and *immediately*

affected by the motions of all the others. On the other hand, the particles of a fluid so impinging will have a *relative motion among themselves*, which materially alters the case. A line of particles occupying the same space, and of the same form with the supposed plank, will not, after impact, occupy the same space, or be of the same form, as the plank when it is made to pass along the vessel.

The illustration which is here introduced of clinker-built boats is hardly to the point. All that may fairly be inferred from the observed facts is, that the water does not escape in such a manner as to produce an upward pressure on the "land" of the plank, the edge of which our author supposes to be a dividing line. But why should it not take a direction having a more *decided dip* than the "land?" There would be no more resistance offered by the "land" to the escape of the water in the one case than the other.

The second and main reason is not much more satisfactory. The connection between the plane in which the impulses of two consecutive particles lie, and the direction in which such particles will most readily escape, must be established before we can accept the conclusion of our author.

We can discover no physical reason why a particle should escape in a direction indicated by the intersection of consecutive normals (which is, in fact, what is asserted by Lord Robert Montagu, at least in his statements); and in this case, since there are two such directions at right angles to one another, to which of these will the particle give the preference; and why? We shall hereafter give a more solid reason for believing that a particle would have a *tendency* to escape along a line of curvature; but then our conclusion will be exactly opposite to Lord Robert's.

The "philosophical principle" alleged as the third reason,—viz., that known as the "principle of least action,"—we admit in full force. The application made of it in the present case we do not so readily allow. We are told, that the dividing line is the *shortest distance* between a point on the stem-post and the stern, and that a particle will necessarily take that path.

This is a somewhat vague and hasty conclusion. Had the question been stated thus: A particle will take that path which, under *all the conditions to which it is subjected, under the action of all the forces by which it is solicited*, is that of least resistance or least effort, we should not have disputed it. At page 126, a cycloidal curve is proposed as a type of the form of dividing lines: and this preference is based on the fact, that the cycloid is the curve of quickest descent from one point in space to another. But in this latter case, the cycloidal form of the brachystochron arises from the nature of the force to which the falling body is subjected; viz., of invariable intensity and of fixed direction. To establish an analogy, it ought to be shown that the *resultant* force acting on a particle of disturbed fluid is of the same nature. Has this been done? We trow not. The analogy, then, completely fails.

To place this matter in a clearer point of view, let us consider some of the circumstances in which a particle of the impinging fluid is placed.

Let us first suppose that there is an equal amount of opposition to the escape of a particle in all directions. The particle then impinging in a certain definite direction (at first horizontal), and with a certain velocity, would (if permitted) rebound from the vessel's side in a direction lying in the same plane with the direction of impact, and the normal at the point of impact with a velocity depending on that of impact—the elasticity between the ship's side and the particle of fluid and the friction. Since, then, the normal is generally inclined downwards, the reflected particle will have a *downward* direction. The particle, however, will not be able to escape thus; the fresh particles *crowding* up will destroy its *horizontal* velocity, and again make it impinge against the ship's side, where the same process goes on as before. The vertical velocity (on our present supposition) is undestroyed, and the particle, therefore, will take a direction in the main inclining *downwards* until it passes

the greatest transverse section, when, from other causes, it will have a tendency to rise. For there will be least pressure evidently where the greatest amount of fluid has been removed, that is at the broader part of the vessel at the load-water line. This reasoning proceeds on the supposition that there is an equal opposition to the escape of a particle in all directions. This, however, is by no means the case.

Suppose a number of particles just impinged on by a vessel in motion: if these were annihilated (which the ordinary theory of resistance supposes), each succeeding group of particles occupying the same position would impinge in the same way. In consequence, however, of their definite bulk, they will impinge on the particles in their immediate neighbourhood; and a succession of shocks in the direction of the vessel's motion will be communicated from one to another, gradually becoming weaker until they will cease. Thus a *wave* in front of the vessel will be produced. Now the particles thus coming up to impinge on the vessel's side will evidently have the *least tendency* to crowd or produce an increase of density (if the fluid were compressible) where there is *greatest deflection* from the tangent line, thaa is in the direction of greatest curvature. Where this tendency is least, *there* will be *least increase of pressure*, and therefore the least opposition to the motion of a particle. Hence, *cœteris paribus*, a particle will have a tendency to escape in the direction of greatest curvature, or taking in its whole course *that line of curvature* which corresponds to the intersections of consecutive normals where the curvature is greatest. Now since, from the usual shape of vessels, this line of curvature is very nearly vertical, and nearly coincides with a transverse section, a particle of fluid would evidently have a tendency to escape directly under the body of the vessel. Lord Robert Montagu's dividing line would coincide more with the line of least curvature, in which there would be, from this cause, the *least tendency* of the particle to escape. On the only ground, then, which he assumes, we conclude that a particle will choose a path nearly at right angles to that which he thinks he has established.

But this is, after all, only a tendency, and therefore we must consider it only as one force of several soliciting the particle. Another force will evidently be called into play, arising from the tendency of the particles to rush towards those parts where the vessel has displaced the water, and would have produced a vacuum but for this tendency of the water to rush in and fill it up. This tendency may be measured in the case of any particle, by a force urging it with an intensity and in a direction depending immediately on the position of greatest vacuum which would be produced were it not filled up—and that in ships of ordinary shape is at the water line, where they are fullest. The effect of this force, therefore, must be in some degree to counteract the other.

To these forces we must add that of gravity, which increases the pressure as the depth below the surface increases, and also the *resistance* on the particle arising from impact against the vessel's side, which will be equal and opposite to the *resistance* of the water against the vessel's side, on the common assumption, and may therefore be taken as very approximately varying as the square of the normal velocity. Further; all these forces can only be conceived as *modifying* the velocity the particles already have relatively to the ship: for although the particles are at first at rest, and the vessel moving; the *relative* velocity, which alone is here to be considered, is the same on the contrary supposition.

Hence, on the conditions which we have imagined, and which do not differ very materially from those which actually exist; to obtain the path of a particle along the surface of the ship, we should have to solve a problem in the calculus of variations of no ordinary difficulty, to say nothing of our ignorance of the *amount* of the forces which we have supposed soliciting the particle along the line of greatest curvature, and towards the stern where there is a tendency to create a vacuum.

Whether the problem, in the form we have proposed it, will ever receive a complete solution is more than we can venture to assert; but this is very certain, that Lord Robert Montagu's conception of it is extremely erroneous, his analogies unfounded, and his conclusions based on no solid foundation.

It is well deserving of consideration whether the end to be attained by the solution of this problem may not be reached by some other and simpler means. Whether, for instance, it be not easier to deal with the *whole wave* produced by the motion of the vessel, not troubling ourselves with the *relative motions* of the particles of fluid in it, and hence draw conclusions of great practical, as well as theoretical, importance to ship-building. Here, too, the theorist must be preceded in his labours by the experimentalist. This is precisely the view of the case taken by Mr. Scott Russell in his wave theory, which may be shortly stated as follows:

Every body in forcing its way through the water throws up, as we have seen, a wave before it. The escape of the fluid aft and the rushing in of the water from behind, cause a second wave differing in form and magnitude from the first wave. To the former of these Mr. Scott Russell gives the name of the wave of translation, and to the latter that of the wave of oscillation. When the motion of the vessel is uniform, each of these waves will take a uniform and definite shape.

Suppose, now, a vessel with a certain form of bow, and therefore causing by its motion a certain wave of translation and oscillation; if the form of the vessel abaft the midship section be accommodated to that of the wave of oscillation, so that the latter fill up exactly, or nearly, the void which would be produced by the motion of the vessel, it is evident that the buoyancy of the water to sustain the aft side of the vessel is greater than under any other arrangement; and since a great part of the force opposing the vessel's motion arises from the diminution of buoyancy aft, this is in a great measure corrected, and the whole resistance so far diminished, and therefore the vessel will move faster. At this stage therefore of the question, we can draw this important conclusion—that for *every form* of bow there is one corresponding form of stern which causes the least resistance, and therefore the greatest velocity in the ship. This may very well explain the cause why vessels with nearly the same *form before* the *midship section* behave so differently; that difference being due to their dissimilarity in form aft.

We may now advance a step further, and seek to discover that form of bow which produces the least wave of translation, or distributes it in such a manner that it shall not be wholly effective in retarding the ship; since the larger this wave is *immediately in front of the ship*, the greater may be supposed its effect in retarding it. This is just what Mr. Scott Russell claims the credit of having done in the *wave form* which he proposes for the bows; and by joining to it the corresponding wave form of stern, he conceives that he has discovered the form of least resistance. Whether this claim be well founded or not, experience alone can decide. The principle itself on which he has proceeded, we believe, is important, and will eventually produce results of no ordinary value in the theory and practice of naval architecture. It may not be out of place here to mention the fact that the *America*, which beat all our yachts hollow last year, has a form essentially agreeing with the wave form; and the *Titania*, which alone made any attempt to hold her own against the *America* is, or rather we regret to be obliged to say was, built on his own principle by Mr. Scott Russell. Before a wind there was little difference in speed between the *America* and *Titania*; on a wind, the *America* gained an easy conquest from her facility in going to windward, arising not so much from the form of her hull as from other causes, which we have not time to particularise here.

We now dismiss the theories of Lord Robert Montagu, and Mr. Scott Russell,

as regards the form of least resistance; and will proceed to lay before our readers a specimen or two of Lord Robert's *mathematical treatment* of the questions which admit of such investigation.

We were much struck, in the chapter on Stability, with the result at which our author arrives, differing so essentially as it does from that of Euler and other eminent mathematicians. The stability of the vessel it must be premised is measured in the ordinary way, and is of the nature of *statical* and not *dynamical* stability. We are told that the metacentre may be below the centre of gravity of the vessel, and the equilibrium nevertheless be stable. Now, when we reflect that a vertical line through the Metacentre is the line of support—that is, the direction of the resultant fluid pressure when the vessel is slightly inclined—it is evident that if this line intersect the vertical line through the centre of gravity in the upright position *below* the latter point, the moment of the fluid pressure will act to increase the angle through which the vessel has heeled, and so to upset it. Until this argument be proved fallacious, we must be permitted to adhere to Euler's views on this point.

Lord Robert Montagu's mode of arriving at this result is equally strange. He obtains an expression for the *vis viva* of the vessel in the following form:

$$\int u^2 d.m + g\varsigma \left\{ b\zeta^2 + (b\gamma^2 \mp \mathrm{V}a)\theta^2 \right\} = c',$$

and it is assumed that the equilibrium is stable or unstable, according as $b\gamma^2 \mp \mathrm{V}a$ is positive or negative. On what mechanical principle this assumption is made, we are at a loss to conceive.

One-half of the *vis viva* is a measure of the *whole work done by the forces;* but gives us no *immediate* means of ascertaining whether the pressure of the fluid acts to bring the vessel back to rest or to make it revolve through a still greater angle. Besides, if anything could be inferred from the expression for *vis viva;* why should the stability depend on the algebraic sign of the term involving θ^2? Yet, our author unhesitatingly draws this inference, as though it were formed on a well-known mechanical principle needing no illustration or argument for its support.

His statements with regard to the rise and fall of the centre of gravity of the vessel are *muddy* in the extreme,—that under some circumstances that point will neither rise nor fall admits of no question. But what will our readers say to the following statement? "We will suppose that the solids of immersion and emersion are equal, so that G (that is, the centre of gravity of the vessel,) neither rises nor falls."

Now, neglecting the *effect of resistance* in increasing the fluid pressure when the vessel heels over, and the resolved part of the force of the wind vertically,—which latter has the effect of slightly increasing the weight of the vessel; the solids of *immersion* and *emersion* must be equal, in order to maintain an equality in the vertical forces acting on the ship; and it is this very necessity which gives rise to the motion of the centre of gravity.

Our author has entirely mistaken the question of rolling, which demands a very different investigation from that which he has bestowed on it.

He also servilely follows Chapman in adopting a false analogy between the rolling of a ship and the motion of a pendulum; and is evidently unacquainted with the advance made of late in the treatment of this question.

At page 88, a figure is introduced, intended to represent the conduct of two vessels with different forms of midship-section. We have seen something very like this in Fishbourne's "Lectures on Naval Architecture." In his explanation of this figure, our author gravely tells us, that "a ship of great stability constantly strains to keep perpendicular to the surface of the water," that surface being not horizontal, but the inclined surface of a wave. Why should it make such an effort? Do the forces act perpendicular to the force of the wave, or to the horizon? If the latter be the case, we conceive the vessel would rather strain (if stable) to keep the line joining the

centres of gravity and of displacement, *vertical.*

We shall next notice a new method of finding the Resultant and Centre of Lateral Resistance. We cannot understand why this question should be separated from that of Resistance in general, which is treated of further on. And as far as we can penetrate the author's meaning, his new method seems to us utterly unphilosophical. His object is, if we understand aright, to find the resultant and direction of a number of forces, which acting in the direction of the normals to the surface at its various points, are *none of them parallel.* And this he does by the simple process of summation. We had always supposed it necessary to resolve each in three directions mutually at right angles, before we could apply any process of summation. But though he were right in his principle, he does not enlighten us as to the applicability of his *new method*, which we in our present state of ignorance must decline to accept.

But of all the peculiarities of the volume before us, there is none more striking than the treatment of the general theory of resistance. And we must express our unfeigned astonishment that any writer in the 19th century using philosophical language in the sense we must suppose in which it is usually understood among philosophers, should speak of water as an *elastic fluid;* sensibly compressible at moderate depths, say 8 to 10 feet below the free surface, of density, and varying with the resistance to the vessel's motion.

The experiments by Oërsted and other great physical philosophers, had induced us to believe it settled that water is not compressible in a sensible degree except under enormous pressures. The well-known experiment of sinking a bottle filled with water to a great depth, with a very slight depression of the cork, and consequently diminution of volume; and that of the particles of water confined in a globe of gold oozing out through the pores of that metal, rather than yield to compression when the globe was flattened, and therefore its elasticity diminished — these experiments we thought were familiar to every tyro.

But Lord Robert Montagu has, it seems, discovered new properties of water; but, in the absence of any information with respect to the experiments on which they are established, we must be pardoned if we adhere to the notion that water is, except under very high pressures, incompressible.

In developing his doctrine of resistance, our author tells us:—"The pressure upon a vessel in motion consists of two parts— (1.) The statical pressure, or that which is exerted equally all over the surface when the vessel is at rest (which altogether equals the weight of the vessel, and the resultant of which acts vertically through the centre of gravity); and (2.) A pressure due to the velocity, and varying with the inclination of OB (Lord R.'s dividing line) to the direction of the motion (that is, the inclination of OB to the axis of x.) The direction of this pressure is perpendicular to the plane in which OB lies, and which is in a tangent plane to the surface of the vessel." In other words, the direction of the resistance is the normal to the surface (which we do not dispute), but its amount depends on the angle which the path that the particle is obliged to describe makes with the direction of incidence. Now this path (if its exact nature could be discovered) is itself the result of several causes depending very much on what takes place *after* the impact on the vessel's surface has been made, and on the motion of other surrounding particles. On the ordinary theory (which our author adopts in every respect but this), the amount of resistance depends on the angle between the direction of impact and the normal to the surface; and since this impact must take place before the subsequent motion of the particle along the dividing line, it seems more natural to conceive that the latter is a consequence (among other things) of the impact, and not a modifying cause of it. The resistance must depend on the velocity with which the particle *directly* strikes the surface—that is, the resolved part of its velocity *before impact*, not *after*, in the direction

of the normal. There are many valid reasons for altering the law of resistance as regards the *power* of this resolved velocity, with which it varies; but *none* for supposing it to vary according to any power of the velocity resolved in any other direction. Were the particles which successively strike the vessel's side *annihilated*, there is every reason to believe that the common law would be strictly true: it is the difficulty thrown in the way of these particles escaping, and the increased pressure which results from this cause, which makes the common law erroneous. We do not see how our author's assumption helps us over this difficulty; nor can we discover any physical reason for it.

But the error of this assumption may be easily seen from a very simple consideration. The dividing line is about the point of incidence a tangent line, and therefore inclined at 90° to the normal. Supposing, then, the direction of incidence, the normal, and the dividing line to be in one plane (and why should they not?); if θ be the angle which the direction of incidence makes with the normal, $90^\circ+\theta$ is the angle it makes with the dividing line, and $cv^2 \cos^2(90^\circ+\theta)=cv^2 \sin^2\theta$ the resistance according to our author; which would involve this extraordinary consequence, that the smaller the angle of incidence—that is, the more DIRECT the impact the less will be the resistance; and if the impact be *direct*, the resistance vanishes!!! *Credat Judæus.*

The author goes on to tell us:—"If there were no friction, the velocity along OB would be the same as the velocity with which the particles impinge (as the particles have really no initial motion, there is *no momentum* to be considered.")

The former of these statements is simply *gratuitous;* the latter, viz., that there is no *momentum* to be considered, is extraordinary enough. If there is impact, there must be *momentum;* and it matters not at all whether the particles are really at rest and the vessel impinges on them, or the vessel be at rest and the particles of water impinge upon it. If there be no momentum, what becomes of the mutual action or resistance? We commend to Lord Robert's serious consideration the old philosophical adage—"*Ex nihilo nihil fit.*" In fact, in that case, we are fighting about shadows, and the vessel, instead of being retarded, must go on moving through the water at an accelerated speed till its velocity become infinite.

That we are not mistaken as to our author's meaning, appears from a statement on the 109th page, where he says:—"But when the vessel is set in motion, the particles of water would meet the vessel with a velocity v, suppose, and exert on a unit of surface (supposing it perpendicular to the direction of the vessel) some force

$$p=\frac{v}{t}$$

where p is *not a moving force*, as there is no momentum to be considered.") Now we will ask the author one simple question: If the force exerted on the unit of surface be not a moving force, then what kind of force is it? If we are answered that it is an *accelerating* force, we ask, in *reply*—Can there be an accelerating without a moving force? Lord Robert has evidently fallen into the trap which catches so many youthful mathematicians. He imagines that there are *two kinds of force*, known as *accelerating* and *moving* forces, and not that these are merely two *different measures* of the same force—the former taking into account only *one* of its effects, the latter its *full* and *complete* effect.

We shall not follow the investigation further, but shall only remark that, in the final result, we have this absurdity presented to us:—There is a factor of the form $1+\delta B^2$ where δB is an area, and therefore of two dimensions. Hence we have the sum of two quantities—one of no dimensions, and the other of four!!! It is as though we added a quarter of an hour to a pound of lead!!!

The last investigation to which we shall invite attention is, that of the relation between the angle at which the sail is set and the leeway when the vessel is on a wind.

The impulse of the wind is first resolved in two directions,—viz., perpendicular and parallel to the keel; the resistance of the

fluid is treated in the same way. Thus, calling w the wind, θ the angle it makes with the sail, R the whole direct, and r the whole lateral resistance, A the area of the sail, and ϕ the angle at which the sail is set to the fore and aft line, he puts

$$A\, w \sin^2 \theta \cos. \phi - r$$

and

$$A\, w \sin^2 \theta \sin. \phi - R$$

for the whole resolved forces acting on the vessel; and calling ρ the resultant, and ψ the angle of lee-way, he puts

$$\rho \cos. \psi = A\, w \sin^2 \theta \cos. \phi - r,$$
$$\rho \sin. \psi = A\, w \sin^2 \theta \sin. \phi - R,$$

and obtains the equation

$$\frac{r}{R} = \frac{\rho \sin. \psi - A\, w \sin.^2 \theta \cos. \phi}{\rho \cos. \psi - A\, w \sin.^2 \theta \sin. \phi}$$

" But ρ must be exactly equal and opposite to the impulse of the wind on the whole area of canvas, which $= w$ A $\sin.^2 \theta$, whence

$$\frac{r}{R} = \frac{\sin. \psi - \cos. \phi}{\cos. \psi - \sin. \phi}."$$

Hence he obtains ultimately

$$\text{Tan.}\ \psi = \sqrt{\frac{d}{e}\ \frac{\sin. \psi - \cos. \phi}{\cos. \psi - \sin. \psi}}.$$

We have here this *very remarkable* way of treating forces, viz., resolving them *all* in two directions at right angles to one another, and taking their differences as the resolved parts of their resultant, and then taking this resultant as equal and opposite to *one* of them, viz., the effort of the wind!! Now if these two forces, viz., the effort of the wind and the resistance of the water, have a resultant, the vessel must move with an accelerated motion in the direction of that resultant; but it is here supposed that the motion of the vessel is *uniform*; that resultant must therefore be *zero*, and not equal and opposite to one of its components.

Not satisfied with this result, our author proceeds to obtain another, which, being in itself a somewhat original idea, he effects in a manner equally original!

He says:—" Since the velocity in any direction varies directly as the impelling force and inversely as the resistance,

$$\therefore V = a\, A\, w \sin.^2 \theta \sin \phi \times \frac{1}{R}$$

$$v = a\, A\, w \sin.^2 \theta \cos. \phi \times \frac{1}{r}$$

$$\therefore \frac{V}{v} = \frac{r}{R} \tan. \phi."$$

And he ultimately deduces the formula

$$\text{Tan.}^3 \psi = \frac{d}{e} \cot. \phi,$$

a result which no powers of ingenuity could make to agree with his former expression.

Euler has investigated the same relation, and his result is

$$\text{Tan.}^2 \psi = \frac{d}{e} \cot. \phi.$$

How are these results to be made to agree, or which are we to prefer, Lord R. Montagu or Leonard Euler? Let us follow out the consequences of this investigation a little further. Our author gives us

$$\frac{V}{v} = \frac{r}{R} \tan. \phi,$$

but

$$\frac{r}{R} = \cot. \phi,$$

$$\therefore\ \frac{V}{v} = 1;$$

that is, the velocities are equal.

We may also ask on what mechanical principle does our author base his assertion that the velocity (supposed uniform) varies as the impelling force directly and the resistance inversely? If this be true, it is a *new* mechanical principle; and all the treatises on this science must be written *de novo*.

Relying on the old principle, we should have said that when the motion is uniform, the impelling force and the resistance are equal and opposite.

We should then have

$$A\, w \sin.^2 \theta \sin. \phi = R$$

and

$$A\, w \sin.^2 \theta \cos. \phi = r,$$

$$\therefore\ \frac{r}{R} = \cot. \phi;$$

but $r = ev^2$, and $R = dV^2$, where e and d are the effective planes of lateral and longitudinal resistance. Also,

$$\frac{v}{V} = \tan. \psi,$$

$$\therefore\ \frac{r}{R} = \cot. \phi = \frac{e}{d}\ \frac{v^2}{V^2} = \frac{e}{d} \tan.^2 \chi;$$

$$\therefore \tan.^2 \psi = \frac{d}{e} \cot. \phi.$$

Euler's formula.

We now take leave of our author. It has caused us deep sorrow to expose errors of so flagrant a character. We would much rather have had to praise where we have now bestowed blame. We do not wish to deter any one from seeking to reap distinction in the field of science; but we would wish every one to know that it is no easy task which he proposes to himself; and that no one has a right to venture there who is not prepared to hold his own against all comers. We would WISH to encourage, but we must, above all things, guard jealously the Temple of Truth. Our duty to the public is paramount; and that we must discharge at the expense of friend or foe. "Amicus Plato, sed magis amica Veritas."

ON IMPOSSIBLE EQUATIONS. BY ROBERT HARLEY, ESQ.

Sir,—I beg to hand you for publication the accompanying postscript to a letter addressed to me some time since by Mr. ROBERT HARLEY, now of Airedale College, Bradford, Yorkshire. It contains the discussion which I mentioned at p. 403, of the 54th volume of the *Mechanics' Magazine*. I reserve my remarks upon it for another opportunity.

I am, Sir, yours, &c.,
JAMES COCKLE.

2, Pump-court, Temple, January 27, 1852.

[*Mr. Harley to Mr. Cockle. Feb.* 5, 1851.]

"In your note accompanying the introductory portion of my paper on Impossible Equations, you express the opinion that such a solution as that which I have given of the equation

$$\sqrt{x} + \sqrt{x+1} = 0,$$

'Is only possible where the roots of a given equation are infinite or zero.' And in a subsequent note (No. 1433, *Mechanics' Magazine*, p. 66), you say that you do not regard the preceding equation as an impossible one. I presume that when you penned the notes in question, you had not perused the latter portions of my paper, as I have there given the roots, in terms of n, of several equations like the foregoing, and yet I think you will admit that these equations are impossible ones. Indeed, it appears to me that we could never with certainty pronounce an equation to be impossible if such expressions as those which I have given as values of x, in the equations just referred to, be accepted as roots; for though it may not always be an easy matter actually to find such expressions, it seems to me to be utterly impossible in any case to prove that such expressions do not exist.

"The following, I think, you will regard as an interesting and useful application of the principles which I have laid down to be observed in the solution of surd equations. Mr. Moors, in his solution of Question 1812, *Lady's and Gentleman's Diary* for the present year (*vide* p. 53) obtains the equation,

$$\frac{a-x}{\sqrt{2ax-x^2+r^2-a^2}} + \frac{b-x}{\sqrt{2bx-x^2+r_1{}^2-b^2}} = 0 \ldots (A).$$

which, solved by the ordinary method, gives

$$x = \frac{ar_1 + br}{r+r_1} \text{ and } \frac{ar_1 - br}{r+r_1}.$$

Respecting these roots, Mr. Moors remarks that 'the first only answers to the condition (A),' and that 'the second is the value of x in

$$\frac{a-x}{\sqrt{2ax-x^2+r^2-a^2}} - \frac{b-r}{\sqrt{2bx-x^2+r_1{}^2-b^2}} = 0,$$

introduced by squaring (A) after transposition.'

"I will now give you my solution. The equation (A) is readily put under the form

$$\sqrt{\frac{r^2}{(a-x)^2} - 1} + \sqrt{\frac{r_1{}^2}{(b-x)^2} - 1} = 0;$$

$$\text{or,}\qquad \sqrt{\frac{r^2}{(a+nx)^2}+n} = n\sqrt{\frac{r_1^{\,2}}{(b+nx)^2}+n};$$

$$\therefore\quad \frac{r^2}{(a+nx)^2}+n = \frac{r_1^{\,2}n^2}{(b+nx)^2}+n^3;$$

$$\therefore\quad \frac{r^2}{(a+nx)^2} = \frac{r_1^{\,2}n^2}{(b+nx)^2};$$

$$\therefore\quad \frac{r}{a+nx} = \frac{r_1n}{b+nx};$$

$$\therefore\quad br+rnx = ar_1n+r_1n^2x;$$

$$\therefore\quad rnx+r_1nx = ar_1n+brn;$$

$$\therefore\quad (r+r_1)\ x = ar_1+br;$$

$$\therefore\quad x = \frac{ar_1+br}{r+r_1}.$$

"You perceive that the foreign root, by this method, is excluded, and the true root is determined almost as easily as by the common method.

"R. H."

LONGMAID'S IMPROVEMENTS IN THE SEPARATION OF SILVER AND COPPER FROM THEIR ORES.

When common salt and minerals containing silver, copper, iron, and sulphur are mixed together, and exposed to the combined action of heat and atmospheric air, mutual decomposition ensues, with formation of sulphate of soda, and chloride of silver and copper, soluble in the alkaline solution thereof. Mr. Longmaid has further discovered that every description of ore containing silver and copper might be treated with great advantage by various modifications of these processes, and the silver and copper economically obtained. The waste of sulphur annually destroyed in the copper works of Great Britain, at an enormous cost of labour and coal, was stated to be from 60,000 to 70,000 tons annually. From this, the original idea was to manufacture sulphate and carbonate of soda. Taking the metals as incidental products in the original process, objections had arisen to its application to ores rich in copper. These were now obviated; and the period was confidently looked forward to when it would be applicable to copper ores generally. The chief points adduced by Mr. Longmaid are, the complete separation of silver and copper, and also lead, when these metals exist in the ore; and the great economy of the process, whereby the sulphur is rendered available for the manufacture of alkali. His late patent refers to the application of the process to ores rich in copper and silver; ores containing about 25 per cent. of sulphur, and from 5 to 10 per cent. of copper, are mixed in such proportion that 32 parts of sulphur by weight are added to 100 parts of common salt. The mixture is ground sufficiently fine to pass through a ten-hole sieve, the material is then calcined in a furnace of four or five beds, commencing at that farthest from the fire, and gradually being advanced by stages to a greater heat; the charge is finished at the bed nearest the fire; the calcined mass, which is called sulphate ash, is conveyed to suitable vats, in which the soluble portions are dissolved, and consist of sulphate of soda, and chlorides of silver and copper. In the rude process of smelting copper ores as at present practised, the sulphur of the ore is not only wasted, but a considerable degree of fuel and labour is employed to destroy this valuable product. The great objection which has hitherto retarded the introduction of these processes into the copper-smelting works arose from a variety of causes. It could only be used practically on a large scale; the copper-smelters were wedded to a practice by which they had realised such enormous profits, they regarded with distrust schemes which they did not understand, and they had a foolish prejudice against becoming alkali manufacturers; neither could the ordinary copper-works be readily converted into furnaces and apparatus for the patent processes; but the astounding fact that the smelters are destroying property to an extent of 50 per cent. on the value of the ore in their present operations, must sooner or later force these improvements into general use.—*Transactions Soc. of Arts.—29th April.*

THE LATE WORKMENS' STRIKE—THE UPSHOT.

The public know that the Amalgamated Society have been defeated, but they do not reckon, or are not informed as to the consequences. Upwards of 30,000*l.* weekly have been lost in wages during the fifteen weeks' strike, by 20,000 skilled operatives, or 450,000*l.* in all. It is a moderate calculation which places the loss of profit and the fixed expenses of the employers at the same amount, so that nearly a million sterling has been deducted from the fund for the *payment* of wages, by the agency of those whose great aim was artificially to *raise* wages. Another ostensible aim of the Executive Council was to elevate the independence of the operatives, and to "rule the destinies of the trade." The result of their stupid and blundering machinations has been to humiliate them far below their former level, by eating the humble pie of the Declaration; and by proclaiming the shameless Jesuit doctrine that they may sign it, and, by mental reservation, break the faith to which it pledges them. But perhaps the most pernicious result of all has been that the operations of the Executive Council have given the employers leisure and opportunity to place their establishments on an entirely new basis, reducing wages, getting rid of inferior hands, employing labourers to do the simple work that was formerly given to skilled hands, and educating a new and much cheaper class of workmen to discharge the duties which formerly were the perquisites of skilled and highly-paid hands. This is so universally the case, that the associated employers have for some time had their establishments in full employment, and that they daily turn away hundreds of redundant operatives, who almost beg for work, and who, doubtless, will very soon undersell the present labour market, and perhaps will ultimately beat down the rate of wages to the Continental level. The most obstinate and insolent will be the most severely dealt with. It will be recollected that the moulders actually dared to demand the dismissal of all who signed the "Declaration," and that now they are the most obstinate of the recusants. Well, that is only hastening their doom. Messrs. Hibbert and Platt, who employ 1,650 operatives, have occcupied their fifteen weeks' leisure in perfecting the most ingenious, but entirely successful apparatus for moulding castings, without the use of skilled moulders at all; and so cheap and complete is the work turned out by this method, that all other engineers will be *compelled* to adopt it, from total inability to sustain competition with it by the continuance of the present system of the application of manual labour to the same class of production. For all ordinary, that is, for nine-tenths of the purposes for which castings are required, the moulders will be *absolutely* superseded; just as, during a former strike, Mr. Fairbairn and his apprentices (driven by necessity, the mother of invention,) devised the planing machine, which cashiered the very men who had been the most troublesome, and had been the chief promoters of the turn-out. Last of all, this hair-brained mutiny has drained dry the exchequer of the Amalgamated and Moulders' Societies; and so impoverished them that, were the employers at present inclined to be tyrannical or revengeful, they could virtually do whatever they please with the operatives, so utterly have they stripped themselves of their resources. The fact is, that crooked means can never ultimately serve an honest cause. The Unionists had no right to make legal and illegal shops—to persecute knobsticks—to demand the dismissal of labourers seeking employment and promotion, as every free Englishman is entitled to do—to prohibit the setting of unskilled men to the unskilled work of planing machines—to restrict the number of apprentices—to threaten to strip every provident man of his whole savings if he worked over-time or by the piece—to set pickets and spies in every factory—to procure returns from every shop weekly of the names and wages of every hand employed, in the view of forcing non-society men into the Trades' Union, challenging the rate of wages, setting apprentices against their masters, and preventing all non-unionists from getting employment. To protect themselves from these practices, and the intimidation, underhand persecution, and open violence by which they were enforced, 25,000 men have sheltered themselves under the protection of the Declaration, and have become so powerful that they have fairly turned the tables on the Amalgamated Society, and *actually threaten to leave any employer who admits a workman to his establishment* WITHOUT *having signed the Declaration*. Such has been the abortive folly and the suicidal mischief of the proceedings of the Unionists. As yet the Association of employers is only partial, and will, having attained its object, probably be dissolved in the natural course of things; its members universally declaring that their establishments have gained immeasurably by the strike, in order, peaceableness, punctuality, and productiveness.—*Weekly Dispatch.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MAY 24, 1852.

ANTOINE DOMINIQUE SISCO, of Slough. *For improvements in the manufacture of chains, and in combining iron with other metal applicable to such and other manufactures.* Patent dated November 15, 1851.

These improvements consist in forming the links of chains, and also anchors, pulleys, and other articles where great strength is required, of a series of layers or laminæ of iron, or iron and steel bound or soldered together.

For the purpose of forming the links of chains, the patentee employs a ribbon or strip of iron, or two strips, one of iron and one of steel, which he winds round a mould of the exact form of link required, and to any desired thickness, and then secures by binding with wire, or by soldering so as to prevent the ends of the ribbon from slipping. The apparatus which he employs for the purpose of forming the links is so constructed as to admit of the link in process of formation being passed through that constituting the end of the chain, so as to form, when completed, a perfect part of a chain, and, by adding link to link in this manner, any required length may be produced. The links may also be riveted instead of being soldered or bound round with wire. The patentee also constructs chains by making the links of a series of flat pieces suitably shaped, which he connects together according to any required thickness or strength of chain by rivets or by soldering. The shells of pulleys are also made in a similar manner.—In constructing anchors the patentee employs a series of plates of metal, which he bends to the form of the shank and flukes, and unites by soldering in a bath of molten lead, using borax as a flux in every case.

Care must be taken that the surface of the plates of which the anchor is composed is cleaned from impurities before immersion in the solder.

Claim.—The modes described of manufacturing chains, and of combining iron with other metal applicable to such and other manufactures.

PIERRE ERARD, of Great Marlborough-street, pianoforte-maker. *For improvements in pianofortes.* Patent dated November 15, 1851.

These improvements comprehend—

1. A method of arranging the strings of pianofortes so as to produce on the sounding-board an equal pressure, both in an upward and downward direction, and so also that the sounding part of all the strings shall lie in the same plane, which has not been hitherto managed when the pressure on the sounding-board has been equalized. This the patentee effects by passing each of the wires through holes in three studs attached to the bridge—the holes in the centre studs being made either at a higher or lower level than those in each of the other studs, so as to cause the wires in passing through the studs to make an angle with the bridge, and thus either exert an upward or downward pressure on the sounding-board. By placing the studs so as to make every alternate wire at the reverse angle to that immediately next it, the pressure on the sounding-board will be exactly balanced.

2. An arrangement for tuning the wires of pianofortes. The ends of the wires, after passing round screws the heads of which keep them from rising, are attached to slides moving in guides on the wrest plank; and these slides are actuated by screws, the turning of which in either direction tightens or slackens the wires accordingly.

3. An improved construction of hammer-butt for "Erard's patent action," in which a regulating screw is introduced at the hammer centre.

CLAUDE FRANCOIS TACHET, of Paris, mathematical instrument maker. *For improvements in preparing wood to prevent its warping or shrinking.* Patent dated November 15, 1851.

The ordinary method of preparing wood to prevent its warping or shrinking, is to employ two or more thin pieces which are united together with the grain laid crosswise, by means of glue or liquid cement, but this mode only partially answers its intended purpose, as glue, or cement, applied in a liquid state is always liable to be affected by a moist atmosphere, and the expansion produced thereby, and the subsequent unequal contraction in drying causes a certain amount of warping. Now the object of the patentee is so to unite pieces of wood together, as to render them independent of atmospheric influences, and this he effects by employing the cement in a dry and powdered state, and applying heat to the exterior of the pieces of wood to be united, so as to effect the melting of the cement by transmission. The cement which the patentee employs is gum lac, alone or in combination with other materials. This he reduces to a powder, and sprinkles evenly over the surface of one of the pieces of wood to be united. He then lays the other piece of wood on the cement-covered surface, and repeats the process of sprinkling cement and applying thicknesses of wood according to

the ultimate required thickness to be produced. He then clamps the pieces of wood together and applies sand heated to about 300° centrigrade to the exterior surfaces, and continues this application of heated sand until the cement is melted, when the sand is removed and the air admitted to cool the wood and set the cement. When quite cold, the prepared wood is removed from the clamping-press, and may then be applied to any useful purpose. The patentee describes an arrangement of apparatus for sprinkling the cement and for heating and applying the sand to be employed for melting the same—and claims,

1. The application of an adhesive substance in a state of powder between the surfaces of shuts or pieces of wood to be united, and the softening and fusing the same by the application of transmitted heat through the thickness of the wood for preserving the same from warping and shrinking.

2. The application of the apparatus for effecting the sprinkling and fusion of the adhesive matter.

3. The apparatus for filling the boxes or drawers with heated sand.

William Charles Scott, of Camberwell, gentleman. *For certain improvements in the construction of omnibuses and other public and private carriages.* Patent dated November 15, 1851.

These improvements are exemplified in their application to an omnibus. The internal seats are divided into separate sittings, the number of which will be varied according to the size of the vehicle. The partitions between the sittings and the framing of the body constitute a complete structure, which for lightness-sake is made of iron work, and the outside panelling is attached thereto. The panelling at the back of each sitting is curved outwards, to give as great an amount of room inside as possible, and the glasses of the vehicle are made of similarly-curved shape. A double flooring is provided to afford protection to the feet of the passengers when persons are entering, and ventilation is secured by a pipe with a bell-shaped mouth exposed to the air, being carried along the interior, the air entering the mouth of the pipe, and being distributed through the vehicle. The ascent to the roof-seats is accomplished by means of a step-ladder provided at the hinder part of the omnibus, above the conductor's footboard, and a railing is carried along the roof in front of the seats, to give support to persons ascending, and while passing to a seat. Such of the above improvements as are applicable may, the patentee says, be adapted to other decriptions of public vehicles, and to private carriages.

Claim.—The combination of parts set forth and described, as regards those portions which constitute what is technically called the "body" of the vehicle—that is to say, the arrangement, general figure, and mechanical construction of the passengers' seats, and the double floor for the protection of the feet, individually and generally, in their combination with the minor conveniences and improvements in the mode of ventilation, the mode of communication between the passengers and the conductor, and between the conductor and the driver of the vehicle [not particularized], the mode of ascending to the roof-seats, &c.; and this in their forms and arrangements respectively as set forth.

Henry Bessemer, of Baxter-house, St. Pancras. *For improvements in producing ornamental surfaces on woven fabrics and leather, and rendering the same applicable to bookbinding and other uses.* Patent dated November 19, 1851.

The *first* improvement consists in ornamenting the surface of woven fabrics by covering the same entirely with bronze powder, and then stamping or embossing the same. The woven fabric (which is preferred to be glazed) is stretched on a table or flat surface, and damped, in order to render it adhesive, by softening the dressing; the bronze powder is then applied, and the fabric passed between heated rollers, by which the dressing is hardened and the metallic powder caused to adhere. By employing one polished roller, a high metallic lustre will be given to the surface of the fabric. It is then in a fit state for use, and may be embossed by any of the means ordinarily employed. It is sometimes necessary to apply a lacquer, and when this is done, the application is made after the fabric has been submitted to pressure, but previous to the embossing.

The *second* improvement consists in producing ornamental surfaces by printing or marking thereon a series of straight or curved parallel lines, and then breaking up the continuity of the lines by ribbing the fabric. The effect thus produced is a combination of that resulting from the process of watering, and of the peculiar play of colours in what are known as "shot" silks. The lines may be produced by the introduction of coloured threads, or they may be printed in bronze powder; and the fabric may be a ribbed one, or the ribbing may be effected by any ordinary process of embossing.

The *third* improvement consists in ornamenting the surface of woven fabrics with leather in the state of "flock," or cemented on in small pieces or strips. In the first

case, the leather is ground to the state of "flock" by the ordinary woollen-flock machinery, and is applied to the surface of the woven fabric (previously covered with cement or with gutta percha), when the cement or gutta percha is in a softened state, by beating in a box, in the same manner as practised in the flocking of paper. The flocked fabric is then passed between heated rollers, by which a smooth surface is produced, together with a grained appearance such as presented by leather. In the second case, the pieces of leather, shaved thin at the edges, are cemented to the surface of the woven fabric so as to cover it entirely. After rubbing with sand paper, the compound fabric is passed between rollers, to give a smoothed surface and grained appearance. Additional ornament may be applied in either case.

The *fourth* improvement consists in exhausting the air from beneath woven fabrics during the time colour is being applied thereto, in order to facilitate the absorption of the colour by the fabric, and to prevent its spreading. The colour may be applied by the ordinary printing process or through a stencil-plate.

The *fifth* improvement consists of an arrangement of apparatus for embossing the backs and edges of the covers of books, and for performing at the same time the operation technically called "backing." This is effected by the use of dies of a curvature suitable to produce the exact form of back required, and to give any ornament to the back and edges of the book covers, which are brought in contact with the book while clamped in a frame, and act on it by the application of pressure in that position.

Claims. — 1. The various methods described of ornamenting woven fabrics by metallising their surfaces.

2. The printing, or otherwise producing, on woven fabrics a series of coloured lines, and afterwards by pressing or embossing, producing such ribs or patterns thereon as will break up the coloured lines in the manner and for the purpose described.

3. The ornamenting of the surfaces of woven fabrics with leather, as described.

4. The formation of a partial vacuum beneath textile fabrics to facilitate their absorption of the colouring matters used in printing or stencilling patterns thereon.

5. The peculiar arrangement of apparatus for producing impressions sunk or in relief on the backs or edges of books, and for giving them any desired amount of curvature.

FREDERICK JOSEPH BRAMWELL, of Millwall, engineer. *For improvements in working the valves of steam-engines for marine and other purposes, and in paddle-wheels.* Patent dated November 20, 1851.

The patentee describes and claims,

1. A mode or modes of working the valves of steam-engines by means of two cranks or eccentrics, or a crank and eccentric, one of which revolves at three times the velocity of the others.

2. A mode or modes of working the valves of steam-engines by means of apparatus worked by hydraulic pressure.

3. A mode or modes of working the valves of steam-engines by means of apparatus worked by hydraulic pressure, and so arranged as to cause the valve to pause at an intermediate part of its stroke.

4. A mode or modes of working the valves of steam-engines by means of steam pressure, or by the raising of a weight, or compression of a spring, or other power in conjunction with hydraulic apparatus, for regulating the motion.

5. A mode of constructing and applying paddle-wheels so that the angular velocity of the float boards may accelerate during their passage through the water, and be greater at the point at which they leave the water than at that at which they enter it.

6. A mode or modes of constructing paddle-wheels so that the angular velocity of the float boards may accelerate during their passage through the water at the same time that they feather, or vary their inclination to the spokes of the wheel.

7. A mode of constructing paddle-wheels with separate float boards, each of which is connected by a spring or springs to the general framework of the wheel in such manner that each board may yield a little on entering the water, and accelerate its velocity in passing through it.

JOHN SHARP BAILEY, of Victoria-terrace, Keighley, Yorkshire, machine woolcomber, and ISAAC BAILEY, of Victoria-street, Bradford, book-keeper. *For certain improvements in preparing, combing, and spinning wool, alpaca, mohair, and other fibrous materials.* Patent dated November 20, 1851.

The improvements claimed by the present patentees comprehend—

1. The application and adaptation to preparing machinery, and their employment therein for preparing wool and other fibrous materials for subsequent operations, of a working cylinder or drum, provided and mounted with moveable rows of teeth, to which variable positions are given, by which they are retained in a vertical or nearly vertical position during the period of time they are in operation on the fibrous material.

2. The application to and employment in such preparing machinery of toothed holding

or retaining rollers, working and operating in combination with a working cylinder or drum constructed as aforesaid.

3. The application and employment in such preparing machinery of drawing rollers operating in combination with a working cylinder or drum constructed as aforesaid, for receiving the wool or other fibrous material from such working cylinder or drum.

4. The application to and employment in such preparing machinery of a working cylinder or drum having fixed rows of teeth, and provided with moveable stripping brushes for removing or stripping the fibrous material from the teeth of the cylinder.

5. The application to and employment in preparing machinery for filling or charging the teeth of combs with fibrous materials to be subsequently operated on, of one or more pairs of porcupine or toothed rollers and brush rollers, for the purpose of operating on the fibrous material and laying the same upon the combs, arranged and operating at equal distances from the teeth of the combs in process of being filled or charged.

6. The application to and employment in such preparing machinery of two or more pairs of porcupine or toothed rollers and brush rollers, placed at different distances from the teeth of such combs to be so filled or charged, and acting wholly or partly in combination, or separately and independently, for the purpose of operating on the fibrous material, and effectually laying the same upon the teeth of the combs.

7. The application to and employment in such preparing machinery of an eccentric wheel or cam, by the action or working of which variable relative positions are given to the combs during the operation of filling or charging.

8. The application to and employment in such preparing machinery of endless bands or chains, provided and mounted with suitable rows of teeth, which are caused to assume or be retained in or near a vertical position during the period of time they are in operation on the fibrous material, for effectually laying the fibrous material upon and delivering it from such rows of teeth, and also placed in an angular position with regard to the teeth of the passing combs, and operating for lashing and partly combing the fibrous material upon such combs.

9. The application to and employment in such preparing machinery of endless bands or chains, provided and mounted with suitable rows of teeth, which are caused to assume or be retained in a vertical or nearly vertical position during the whole period of the movement or traverse of the endless chains or bands—the fibrous material being drawn off or delivered from the same side of the rows of teeth as that which is towards the feeding rollers at the time of the material being fed upon them.

10. The general construction, arrangement, and movement or operation of certain parts shown and described, constituting a a combing machine, and its application and employment for combing wool and other fibrous materials.

11. The application to and employment in machinery for combing wool and other fibrous materials of moveable or swinging frames, carrying branch combs or teeth acting in combination with a rotary frame carrying combs or teeth.

12. The mounting upon each branch comb-frame employed in such improved machine for combing wool and other fibrous materials two branch combs, one of which being in operation of combing the fibrous material, the other will be inactive, for the purpose of facilitating the changing and transferring of the combs into and from the machine.

13. The arranging and working of combing machinery in which revolving combs and more than one branch or fellow comb are employed for combing or operating on fibrous materials, so that one revolving and one branch or fellow comb only can be working at the same time.

14. The stopping or suspending the delivery of the roving in throstle frames, or other similar machinery employed in spinning wool and other fibrous materials, when the thread breaks between the delivering roller and the flyer, or when the tension of the thread slackens, by the action of a wedge or tongue against the roving and between the rollers.

15. Effecting the same object under similar circumstances by moving or shifting the roving into a groove made in one or both of the back or feeding rollers, and thereby relieving the roving from the nip or pressure of such rollers.

16. The application and employment in throstle-frames, or other similar machinery used in spinning wool and other fibrous materials, of a disc mounted loosely upon the upper part of the spindle, or upon the boss of the flyer, and capable of rotary motion, for the purpose of preventing the thread, when passing to the bobbin, from coming in contact with the upper flange or edge of such bobbin.

Thomas Statham, of Sydney-street, City-road, pianoforte-maker. *For certain improvements in pianofortes.* Patent dated November 20, 1851.

Claims.—1. A peculiarly-formed stop or stops adapted and applied to the wrest-plank, and also to the sounding-board of

pianofortes, for the purpose of maintaining a greater uniformity of tension on the string, and relieving the sounding-board from pressure by the string. (The stop is so formed that the string, in passing through it, is caused to make an angle with the sounding-board at one end and with the wrest-plank at the other end, so that the sounding part of the string is strained over and supported, as it were, by two metallic bridges, by which the vibration of the string, when struck by the hammer, is confined to the part included between these bridges.

2. Another form of stop, similarly adapted and applied, for the same purpose.

George Mills, of Southampton, engineer. *For improvements in steam engines, boilers, and in steam-propelling machinery.* Patent dated November 22, 1851.

Claims —1. The employment in steam-engine boilers of flat-sided flues, having indentations or corrugations (two or more) therein, touching and abutting against one another on the protuberant sides, and forming water spaces on the hollow sides.

2. Certain improved arrangements of steam-propelling machinery respectively represented and described, each in the peculiar arrangement and combination of known parts of which it consists.

3. The constructing of the pistons of steam engines of a chambered or box form, represented and described.

Thomas Marsden, of Salford. *For improvements in machinery for heckling and combing flax, and other fibrous materials.* Patent dated November 22, 1851.

These improvements have relation to the well-known heckling machine of Mr. P. Carmichael, and consist in

The application of more than one line of holders, and fixed and revolving holder-seats, alternately, or all revolving holder seats in those machines in which the flax is dressed at both sides of one end over a single body of heckles moved in the same direction by the same shaft or shafts, such lines of holder seats, &c., to be raised from and lowered to the heckles, and the holders turned or removed by the same lifting and reversing apparatus.

Enoch Statham, of Siddal's-road, Derby. *For improvements in the manufacture of lace and other fabrics.* Patent dated November 22, 1851.

These improvements consist in the manufacture of lace and other fabrics on twist lace or bobbin-net machinery, by giving to every alternate carriage in such machines a constant motion through, between the warp threads, in the opposite direction to that in which the next adjoining carriage is moving. Heretofore, in working such machines with a single tier of carriages, the carriages have been moved in an unbroken row from front to back, or from back to front, and when passing from selvage to selvage, one half of the carriages (every alternate carriage) has been taken to the back, and the other half has been taken to the front. The means by which the motion of the carriages is effected according to the patentee's invention, may be varied so long as each alternate carriage is caused to move constantly in a direction opposite to that in which the neighbouring or next adjoining carriage is moving through between the warp threads.

Claim. — The manufacture of lace and other fabrics in twist lace or bobbin-net machines, by causing the neighbouring or succeeding carriages in such machinery to be moved constantly in opposite directions.

Frederick Weiss, of the Strand, surgical-instrument maker. *For improvements in certain surgical instruments, also in scissors and other like cutting instruments.* (Being a communication.) Patent dated November 22, 1851.

These improvements have relation to surgical and other cutting instruments of the scissors class, in which the cutting parts or blades move on an axis, and consist in so connecting the two parts or blades of the instrument to each other that, during the act of cutting they shall be drawn close to each other, thus enabling a cut to be made with the left hand as efficiently as with the right. This is effected by making the axis or pin on which the blades of the instrument turn with an enlarged head or shoulder, the under part of which is bevelled off; and when in the act of closing the scissors or instrument to make a cut, this bevel or incline acts on the moving blade, so as to press it close to the other blade, and thus secure an effective cut.

Claim.—The mode described of connecting the limbs of surgical instruments, also of scissors and other like cutting instruments.

Specification Due, but not Enrolled.

Samuel Colt, of Bond-street, Middlesex. *For certain improvements in fire-arms.* Patent dated November 22, 1851.

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Watt, of Glasgow, Lanark, North Britain, manufacturing chemist, for improvements in the treatment and preparation of flax or other fibrous substances, and the application of some of the products to certain purposes. May 22; six months.

David Dick, of Paisley, Renfrew, North Britain, machine-maker, for improvements in the manufacture and treatment or finishing of textile fabrics and materials. May 22; six months.

Richard Roberts, of Manchester, engineer, for certain improvements in and applicable to boats, ships, and other vessels. May 22; six months.

John Harcourt Brown, of Aberdeen, Scotland, and John Macintosh, of the same place, for improvements in the manufacture of paper and articles of paper. May 22; six months.

Louis VictorRuzé, manufacturer, of Gaillon, France, for certain improvements in the manufacture of hat-plush and other similar silk cloths. May 22; six months.

John James Russell, of Wednesbury, Stafford, patent tube manufacturer, for improvements in coating metal tubes. May 22; six months.

Edward Thomas Bainbridge, of St. Paul's Churchyard, for improvements in obtaining power when fluids are used. May 22; six months.

Samuel Cunliffe Lister, of Manningham, near Bradford, York, machine wool-comber, for improvements in treating and preparing, before being spun, wool, cotton, and other fibrous materials. May 22; six months.

John Swarbrick, of Blackburn, Lancaster, fire-brick manufacturer, for certain improvements in the method of manufacturing retorts used for gas and other purposes, and in the apparatus connected therewith. May 22; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for certain improvements in winnowing machines. (Being a communication.) May 22; six months.

Thomas Knott Parker, of London-wall, Middlesex, carpenter, for improvements in window sashes. May 22; six months.

Johann Stierba, of the firm of Messrs. Eisbrick and Co., of Prague, Bohemia, gentleman, for improvements in furnaces, and in heating and utilising certain products of combustion. May 22; six months.

John Mason, of Rochdale, Lancaster, machine maker, and George Collier, of Halifax, York, manager, for certain improvements in preparing, spinning, twisting, doubling, and weaving cotton, wool, and other fibrous materials; also in tools or apparatus for constructing parts of machinery used in such manufactures. May 22; six months.

Joseph Walker, jun., of Wolverhampton, Stafford, merchant, for certain improvements in vacuum pans for the evaporation and crystallisation of saccharine or other solutions. (Being a communication.) May 25; six months.

Henry Webster, of Manthorpe, Lincoln, wheelwright, for improvements in regulating the draft in chimneys or flues. May 25; six months.

LIST OF SCOTCH PATENTS FROM 22ND OF APRIL TO THE 22ND OF MAY, 1852.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in the method of, and apparatus for indicating and regulating the heat and the height and supply of water in steam boilers, which said improvements are applicable to other purposes, such as indicating and regulating the heat of buildings, furnaces, stoves, fireplaces, kilns, and ovens, and indicating the height, and regulating the supply of water in other boilers and vessels. (Communication.) April 23; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the manufacture of lenses. (Communication.) Aprill 26; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
May 21	3262	J. Wanthier	Wilmington-square	Portable and house barometer.
,,	3263	W. C. Cambridge	Bristol	Straw shaker.
22	3264	R. Mallet	Dublin	Iron plate for roofs.
,,	3265	C. Lenny	Croydon	Carriage-wheel plate.
24	3266	A. J. Schatt	St. James	Royal Cambridge valve bugle.
25	3267	R. W. Winfield	Birmingham	Spring letter balance.
26	3268	W. Quinton and Co.	Birmingham	Rule joint.
,,	3269	W. Dray and Co.	London-bridge	Cradle machine for washing and gold detecting.
,,	3270	G. Harriott	North Walsham	Screw clod crusher.
27	3271	C. Richards	Birmingham	Core peg for Minié rifle-bullet moulds.

Erratum—In the signature to the article on "Blowing Fans," p. 406, *for* "Hayworth" *read* "Haworth."

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburg.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

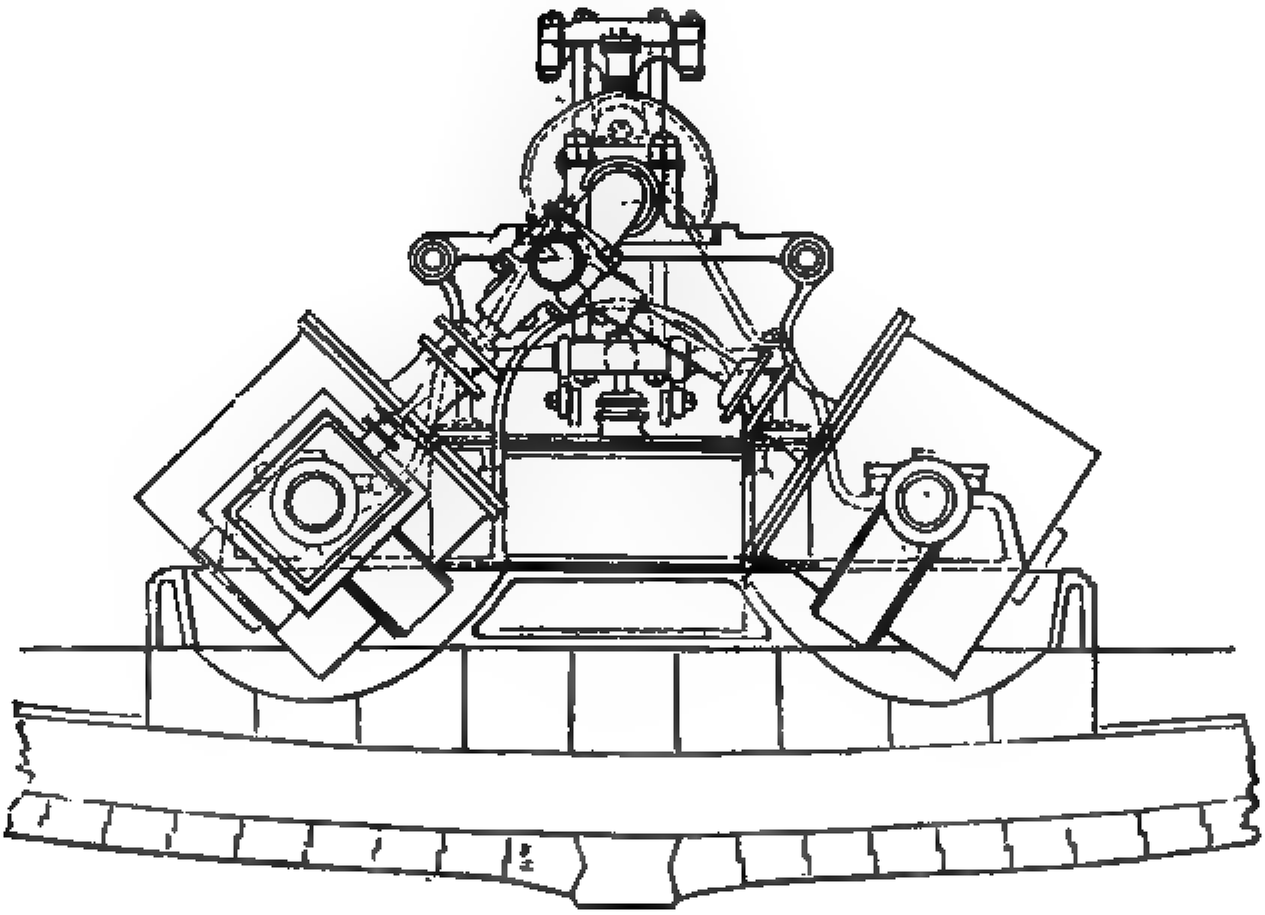
No. 1504.] SATURDAY, JUNE 5, 1852. [Price 3*d.*, Stamped 4*d.*

Edited by J. C. Robertson, 166, Fleet-street.

MAIN'S HELICAL WHEEL STEAM ENGINE.

Fig. 3.

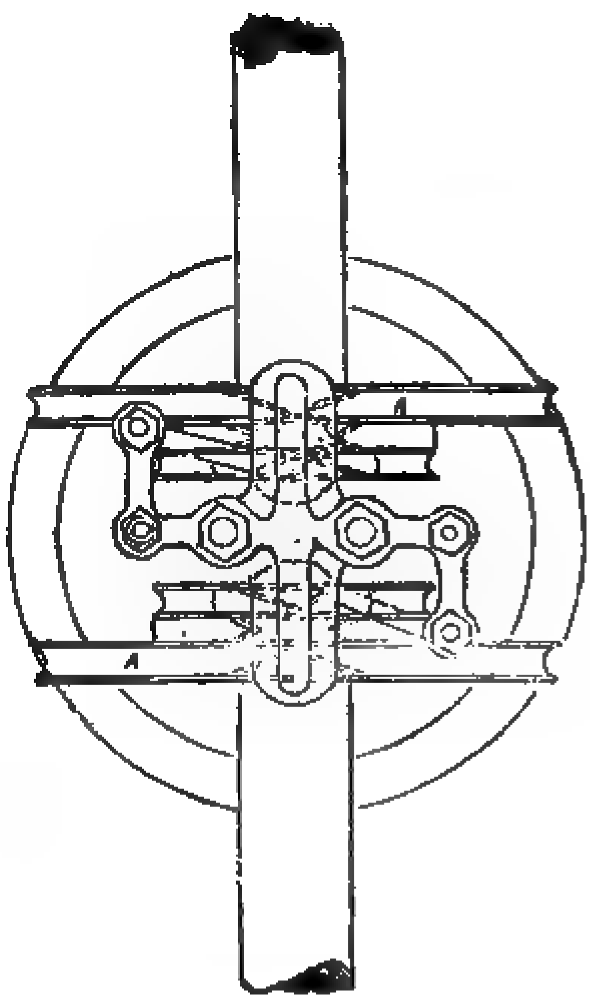
Fig. 4.



MAIN'S HELICAL WHEEL STEAM ENGINE.

The helical wheel is a very ingenious contrivance of Mr. David Main's for working the air and other auxiliary pumps of steam engines at one-half the speed of the engines themselves; and is included under the same patent, from the specification of which we have in previous Numbers extracted so largely, (*see ante*, pp. 241, 261, and 281). An elevation and plan of this wheel, as seen when detached from the engines are given in figs. 1 and 2; and the following is the inventor's description of it:—

Fig. 1. Fig. 2.



"I accomplish this (the working of the pumps at half speed), by causing the working shaft to actuate the pumps through the medium of rollers travelling or rolling on the peripheries of a peculiarly-shaped wheel A. The periphery of this wheel is a geometrical helix, or volute, the curve of which recedes regularly in the course of one revolution from the point nearest to the centre to that part which is most distant from it, and again, in the course of another complete circuit, returns to the point nearest to the centre; and the helices of the two pumps are so adjusted, that as one pump finishes its stroke, the other shall be just commencing its stroke. Farther, the one pump is connected by a lever with the other, so that the one shall assist in the return stroke of the other; that is to say, the ascent of the one pump is made to correspond with the descent

of the other. In this way the air-pump may be worked at a moderate speed, as compared with the speed of the working shaft. And supposing this arrangement to be applied to any direct-acting engine with one condenser, one pump would be always in action, and the cylinder always playing into a condenser in a course of constant exhaustion; working consequently with great energy, as the pumps would work at only half the velocity of the steam pistons. The steam pistons would, in fact, be thus set free, as it were, from the usual encumbrance of the air-pumps, and a range would be given to the speed of direct-acting steam engines, much greater than has been hitherto accomplished in connection with condensing engines."

An engine complete, with the helical wheel included, is given in figures 3 and 4 on our front page.

APPLICATION OF HYDRAULIC POWER TO INDUSTRIAL PURPOSES.

It does not seem probable that arrangements for the supply of water to the metropolis will include the application of hydraulic power to industrial purposes, but as the General Board of Health have indicated the advantages derivable from this force where only required occasionally, as also for manufacturing purposes on a small scale, it seems well worth considering whether the erection by private persons of powerful steam engines for raising water, then letting it out in small quantities, might not be highly remunerative to the undertakers.

Some great manufacturers on the banks of the Thames have constant employment by day for powerful steam engines, but none during the night. To such persons it would be particularly advantageous to work their engines at night in raising water to elevated reservoirs, ready to be let out as a motive power.

One immense cistern might cover the roof of the water-raising factory; or otherwise, each customer for water might have a cistern on the roof of his own establishment: in both cases, pipes would have to be laid from the steam engine to the several wharves or workshops.

Separate cisterns would greatly facilitate the ascertainment of the quantity of water each customer would consume—since, by replenishing his reservoir only when empty, or by gauging the water in it each time of filling it up, the quantity given would be correctly ascertained. In cases of fire, too, a pipe descending from such a cistern would furnish an *instantaneous* supply of water. On the other hand, it could hardly be expected that buildings for small workshops would be of sufficient height to ensure a competent hydraulic pressure. The principal reservoir would in both cases be immediately available in case of fire.

On the banks of the Thames so many wharfs are situated, and in their immediate vicinity so many industrial establishments are located, that ample employment for several powerful steam engines seems hardly to be doubted. Independently of manufacturing operations, the unloading of ships, and stowing away the goods they bring, would be better, as well as more cheaply done by steam or hydraulic power than by manual labour. The delivery, under cover, of articles damageable by wet, for example, and the raising of coals from the hold of a ship. By speed in unloading or loading a vessel, much damage might be saved without the need of having recourse to any of our spacious but costly docks, and the river itself might thus be freed from much of its present choking up by vessels waiting to be unloaded.

At the last conflagration at Bermondsey—as so often happens south of the Thames—there was a deficiency of water; but as Thames water, with all its impurities, is not unsuitable as a motive power, or for extinguishing fire, it would be well that the forcing pumps suggested should be fed from the river, and that by means of pipes carried down to somewhat below the lowest low-water mark,—the apertures of the pipes being, of course, protected from gravel, &c., by suitable straining mouths.

Loss of property by conflagration is looked upon with regret for the immediate sufferers, if not insured; but, at the same time, little commiseration is felt for losses incurred by insurance companies, and the loss to the nation at large is never thought of: yet every loss by fire is a loss to the *nation;* it is the anni-

hilation of so much of its capital,—a capital which, directly or indirectly, would have given employment to many of the industrial class. Hence patriotism, no less than personal interest, should lead in such works to combine with them fire-extinguishing apparatus. For this purpose it would need only to provide upon the mains short branch pipes reaching up to the surface of the ground, to fix upon them stop-cocks prepared to receive flexible hose, they having appropriate screws at one end, and suitable jets or spreaders at the other. The power of a 30-horse steam engine was sufficient at Portsmouth to raise water by a force-pump of 8 inches clear diameter, and to force the water so raised, through, at one and the same time, six of the largest hose of fire engines, throwing a jet of water to the height of from 60 to 70 feet. An engine of 100 horses power might, therefore, be expected to force water to the same height, and at the same moment, through a score of such hose—more than are usually worked together in the instance of any conflagration. According to General Bentham's proposal of fire-extinguishing works for Portsmouth Dockyard, in 1801, the branch pipes and stop-cocks were placed at an average of 100 feet apart; it might be desirable that, in a crowded neighbourhood, they should be nearer to each other.

The project, though confined above to the banks of the Thames, for elucidation sake, seems equally applicable to manufacturing districts generally. Steam power has, for more than half a century, been let out at Manchester, for instance. Why should not hydraulic power, as a private speculation, be so likewise? Indeed, the latter is endowed with the quality of subdivisibility in a pre-eminent degree. The General Board of Health have already observed that it might be applied to so small an amount as that of the force of a single man, or of a boy.

M. S. B.

THE EXCISEMAN'S STAFF QUESTION.

Sir,—I beg to offer a few remarks on Mr. Smith's solution of the "Exciseman's Staff Question," which appeared in No. 1502; since that gentleman has considered the question open to further discussion.

In the first place, it is wrong to suppose that the weight of the staff will be either increased or diminished by the friction on the edge of the vessel. For we may suppose the staff to be loosely connected to the edge of the vessel by a hinge, and the equilibrium will be exactly the same. In determining the conditions of equilibrium of the staff under such circumstances, it is not necessary to take into account the pressure on the hinge. The only condition to be fulfilled is, that the sum of the moments of all the forces about the hinge must be equal to zero. We are not permitted to introduce into such an equation of moments, representing the equilibrium of a rigid body, an isolated force, as Mr. Smith has done, in equation (3), connected by the sign $\pm$. The first part of Mr. Smith's solution is correct, and has been given in another place. I need only add, that in the question as originally proposed, the staff was supposed capable of free motion about the extremity in contact with the vessel, which was supposed fixed, without regard to its slipping in either direction.

Yours, &c.,

SEPTIMUS TEBAY.

Haversham, May 25, 1852.

METHOD OF OBTAINING A CONTINUOUS CURRENT OF COLD AIR.

Sir,—Perhaps the following hints may be of service to some who are suffering from the oppressive heat of a tropical climate; viz., a method of obtaining a continuous current of cold air. The dwelling should be proximate to a stream. Provide a long iron tube, capable of bearing an internal pressure of 70 lbs. or 80 lbs. to the square inch, and protected by a safety-valve. Connect an air-pump, which may be worked by the stream, at one end, and a small pipe, leading to the lowest apartment of the house, at the other. This pipe is closed, but a minute aperture—a pin-hole, is opened at each vibration of a pendulum, which is kept in motion by the puffs of air emitted from the aperture. The tube being placed at the bottom of the stream, air is pumped in until the gauge indicates the desired pressure; the pendulum is then set in motion and adjusted to release the same quantity of air as that continued to be forced in at the opposite end; this might

very simply be self-adjusting. The air when compressed becomes heated, and while passing through the tube, imparts its caloric to the water, issuing into the house in intermittent jets at the ordinary temperature of the atmosphere, but at twice or thrice its density; consequently, in expanding to two or three times its former bulk, the temperature would fall to one-half or one-third, according to the pressure. By keeping the windows closed, by providing proper means of circulation for the air, and its escape at the roof, a dwelling might be kept at any moderate temperature.

I am, Sir, your obedient servant,

R. W.

MATHEMATICAL PERIODICALS.

(Continued from page 147.)

XXVII.—*The Mathematical Repository.—Original Papers Continued.*

Art. I. Part. II. Vol. IV. On combinations. By Mr. R. J. Dishneagh.

Prop. I. If any limb has n muscles, each having m distinct motions, determine the number of motions when p muscles act at once.

Prop. II. To determine the *total* number of motions which can be exerted by the limb.

Art. II. On Attractions to Spheroids of small eccentricity. By Mr. R. J. Dishneagh.

Art. III. On finding the Earth's Axes. By Mr. James Adams.

Art. IV. Mathematical Scraps. By Mr. Thomas White, of Dumfries.

Scrap. I. To exhibit the square root of 2, 3, 5, 7, 11, &c., in affirmative terms of the powers of 2.

Scrap. II. To show that any equation may be generated by the *addition* of its component equations.

Scrap. III. Concerning equations. [In this scrap Mr. White examines the composition of the equation $x^3 - (a+b+c)x^2 + (ab+ac+bc)x - abc = 0$, which arises from $(x-a)(x-b)(x-c) = 0$, by the usual methods. He afterwards expresses the three roots by x, x', x''. and deduces the corresponding formula for these three *different* unknowns, and by "splitting it into three equations" determines $x=a$; $x'=b$; $x''=c$; as is known by the ordinary solution of a cubic. He concludes by observing, that "the difficulty of applying the considerations suggested by these equations to one of the usual form, $x^3+px^2+qx+r=0$, remains unremoved," for, "after all, how are a, b, c, to be found from p, q and r? Here is the rub!" To this question I am not prepared to give an answer, but may remark, that it has always appeared to me extremely *illogical* to deduce an equation in x^3 from the multiplication of such factors as $(x-2)(x-3)(x-4)=0$, *knowing*, as we do, *à priori*, that every one of the roots are *unequal*, and that no such term as x^3 can be obtained in the resulting equation, except on the supposition *for the instant*, that all the roots are *equal*.]

Scrap. IV. A transformation of equations by which their roots may be approximated, especially when the coefficients and absolute term are considerable.

Scrap. V. About A, let a rigid rectilinear rod A B C revolve, and let B C D E be a jointed parallelogram having given rigid sides:—now supposing the $\angle$ D to move in a vertical right line G H, what is the equation of the locus of the $\angle$ E? [This locus is connected with the "parallel motion" as applied to the steam engine, and was proposed to Mr. White by "a young gentleman connected with Messrs. Boulton and Watt."]

Scrap. VI. Let B F cut a given circle and C be any point therein; and in it let another point D be taken, such, that $BC, DF = CD^2$:—then if any point P be taken in the circumference and P C, P D, be drawn cutting the circle in n and m; PD. Dm, BD = PC, Cn, CF.

[This theorem, Mr. White observes, might seem to revive "the hope of solving, geometrically, the ancient problem of the duplication of the cube, by considering the point C in the centre of the circle." The difficulty lies in "determining P'D and BD such, that a circle will pass through B, P', and F, so as to make BC : CD : : CD : DF." Mr. White published the Theorem in the *Repository*, in order to establish his claim to its discovery.]

Art. VI. A Problem [on the generation of the hyperboloid and paraboloid by means of a right line moving along two other right lines.] By Mr. Peter Nicholson.

Art. VII. An expeditious method of ascertaining the Factors of Composite

numbers, and of finding Prime numbers. By Peter Barlow.

Art. VIII. On Projectiles by Geometry and by Analysis. By Mr. Peter Barlow.

Art. IX. On the Summation of Series which are expressible by a general term. By Mr. Peter Barlow.

Art. X. A New Property of the Parabola. By Lieutenant Drummond, of the Royal Engineers.

[This property contains a generalisation of that which asserts that the "area of any parabola $= \frac{2}{3}$ of its circumscribing parallelogram," and was transferred, somewhat modified, into the eleventh and twelfth editions of *Hutton's Course*. Lieutenant Drummond's investigation is strictly geometrical; and an analytical one is supplied by Mr. Barlow, who communicated the paper to the *Repository*.]

Art. XI. On Cubic Equations. By Mr. Mark Noble.

[This paper is introduced by an extensive "history of Cardan's rules," which concludes by remarking that the method proposed "serves to assimilate the solutions of quadratics, cubics, and biquadratics as solved by Ferrari and Waring . . . . . to one general principle; viz., completing each side of the equation to a perfect power, such that the exponent of, the one power shall be equal to, or a multiple of the exponent of the other." The method is as follows: Let the equation be

$$x^3 - qx - r = 0.$$

Find the two roots of the quadratic

$$y^2 - ry + \frac{q^3}{27} = 0,$$

let there be y' and y''; then

$$x = \sqrt[3]{y'} + \sqrt[3]{y''}.$$

Mr. Noble remarks, that

$$x^3 + px^2 - r = 0,$$

may be resolved in a similar manner "*without previous reduction*," and the method "may be applied *immediately* to the complete cubic,

$$Ax^3 - Bx^2 + Cx - D = 0."]$$

Art. XII. The Blind Abbess. By Mr. W. G. Horner, of Bath.

[In the introductory remarks to this paper, Mr. Horner observes that "everybody has heard the story of the good Blind Abbess, and what tricks were put upon her by the knowing sisterhood under her care . . . . The business is to fill the *eight* external cells of a square having nine compartments, with numbers; in such a manner that whatever be the sum of the whole eight numbers, the sum of each three which stand in a row shall constantly be the same. The subject had been partially considered by Ozanani and Montucla, but the present essay contains the first attempt "to discover in how many ways it was possible to vary the cheat."]

Art. XIII. Investigation of a Rule for finding the Latitude. By Mr. John Bransby.

Art. XIV. On the Thickness of Wharf Walls, &c., to support a Bank of Earth. By Mr. John Adams, of Stonehouse.

Art. XV. Solution of a Dynamical Problem. By A. B.

Problem.

To find the motion of a body animated by two forces, one of which acts in the direction of the radius vector, and the other at right angles to it.

Art. XVI. An Indeterminate Problem. By Mr. James Cunliffe.

Problem.

To find a plane triangle, such that all its sides, perpendiculars, and lines bisecting the angles, may all be expressed by rational numbers.

Art. XVII. Mathematical Scraps. By Mr. Thomas White.

Scrap 1.—Dynamics.

Scrap 2.—Conics.

[In the *first* scrap the principles of Dynamics are deduced without the aid of geometry; and in the *second*, the properties of the ellipse, the hyperbola, and the parabola; are derived, by means of the circle, "independent of either their determining ratio or the cone."]

Art. XVIII. The Blind Abbess. An addition to Art. XII. By Mr. W. G. Horner.

Art. XIX. An omission supplied in the reprint of Speidell's "*Logarithmotechnia.*" By S.

Art. XX. Four papers. By Mr. Thomas Knight, of Papcastle.

No. 1. On the Summation of Series. Extension and Illustration of Spence's "*Transcendents.*"

No. 2. A general expression for

$$\int \phi(x) d\psi(x).$$

No. 3. The summation of certain figurate series.

No. 4. To express

$$x^n \pm \frac{1}{x^n},$$

n being a whole positive number, by series arranged according to the powers of

$$x + \frac{1}{x}.$$

Art. XXI. Certain properties appertaining to a triangle inscribed in a given circle, having two of its sides in a given ratio. By Mr. James Cunliffe.

[This paper is divided into twenty-one paragraphs, and contains many curious properties of the inscribed triangle, under the given conditions, well worthy the attention of the geometer.]

Art. XXII. A method of obtaining the sum of an infinite series of the form

$$Ax^n + Bx^{n+1} + Cx^{n+2} + Dx^{n+3} + \&c.,$$

in which the quantities A, B, C, D, &c., are expounded by a series of the sines or cosines of circular arcs in arithmetical progression; together with some other curious particulars deduced therefrom. By Mr. James Cunliffe.

Art. XXIII. On the popular Methods of Approximation [to the Roots of Numerical Equations]. By Mr. W. G. Horner.

[This paper is evidently intended by its author to draw attention to his method of solving numerical equations which had just before been published in the *Philosophical Transactions*. He here reviews the methods which had been proposed for effecting the same object by Newton, Raphson, Barlow, Halley, De Lagny, Hutton, Lagrange, and Budan, pointing out as he proceeds the merits and demerits of the processes employed by each of these writers, and concludes by directing the attention of his readers to the paper previously alluded to, where "he has laboured to render the solution of an equation, from first to last, a purely *arithmetical process, direct and certain*, easy to be remembered, and easy to be practised." No one who understands "Horner's Processes," will hesitate to admit that in these respects Mr. Horner has been eminently successful.]

The *third* part of this volume consists of seventy-six pages, entirely occupied with the Cambridge "*Senate-house Problems*," from 1814 to 1819 inclusive. Several short Obituary notices of Lagrange, Spence, Glenie, Morge, &c., occur in other parts of the volume, which are also accompanied by abstracts of the Transactions of the principal learned societies of England, Scotland, and France; lists of new mathematical publications, &c.; but as most of these are necessarily short and imperfect, they do not appear to require further notice.

T. T. W.

Burnley, Lancashire, May 25, 1852.

THE HOT BLAST.

The observation is a trite one, that useful inventions have often been suggested, then dropped for years, until they have been devised anew. It has been thus with the hot-air blast—as old in its recommendation as the year 1782. In that year Sir S. Bentham, on his return from an examination of the mines in Siberia, presented to Her Imperial Majesty Catherine the Second of Russia heads of various improvements which he conceived applicable to those mines. He was, in consequence, honoured with a private audience of the Empress, and preparatory to it drew up notes of the particulars on which he purposed to enlarge. The second article of the "*tableau*" he had already presented was—"*Des differents operations sur les mineraux pour les faire rendre une plus grande proportion de metal, et en même temps pour ameliorer sa qualité.*"* Other articles indicated means of saving fuel—a very important consideration. One of his notes on these subjects is as follows: "Bellows may be supplied with their air, *not* from the *cold atmosphere*, but from the heated air, which, from its levity, rises to the top of the building, and from whence it may be led down to the inhaling apparatus of the bellows by a pipe."

ERICSSON'S CALORIC ENGINE.

[From the *Boston* (United States) *Evening Transcript*.]

"The idea of substituting a new and superior motive power for steam will, no

* "Of the different operations on minerals, by which they may be made to yield a greater proportion of metal, and at the same time to improve its quality."

doubt, strike many minds as extravagant, if not chimerical. We have been so accustomed to regard steam power as the *ne plus ultra* of attainment in subjecting the modified forces of Nature to the service of man, that a discovery which promises to supersede this agency will have to contend with the most formidable preconceptions, as well as with gigantic interests. Nevertheless, it may now be predicted with confidence that we are on the eve of another great revolution, produced by the application of an agent more economical and incalculably safer than steam. A few years hence we shall hear of the 'wonders of caloric,' instead of the 'wonders of steam.' To the question, 'How did you cross the Atlantic?' the reply will be, 'By caloric, of course!' On Saturday I visited the manufactory, and had the privilege of inspecting Ericsson's caloric engine, of 60 horse power, while it was in operation. It consists of two pairs of cylinders, the working pistons of which are 72 inches in diameter. Its great peculiarities consist in its very large cylinders and pistons, working with very low pressure, and in the absence of boilers or heaters, there being no other fires employed than those in small grates under the bottoms of the working cylinders. During the eight months that this test-engine has been in operation, not a cent has been expended for repairs or accidents. It is a beautiful and imposing object, and conveys the idea of power and symmetry much more impressively than the largest steam engine that I have ever seen. The leading principle of the caloric engine consists in producing motive power by the employment of the expansive force of atmospheric air, instead of that of steam; the force being produced by compression of the air in one part of the machine, and by its dilatation by the application of heat in another part. This dilatation, however, is not effected by continuous application of combustibles, but by a peculiar process of transfer, by which the caloric is made to operate over and over again, viz., the heat of the air escaping from the working cylinder at each successive stroke of the engine, is transferred to the cold, compressed air, entering the same; so that, in fact, a continued application of fuel is only necessary in order to make good the losses of heat occasioned by the unavoidable radiation of the heated parts of the machine. The obvious advantages of this great improvement are the great saving of fuel and of labour in the management of the engine, and its perfect safety. A ship carrying the amount of coal that the Atlantic steamers now take for a single trip, could cross and re-cross the Atlantic twice without taking in coal; and the voyage to China or to California could be easily accomplished by a caloric ship without the necessity of stopping at any port to take in fuel. Anthracite coal being far the best fuel for this new engine, we shall no longer have to purchase bituminous coal in England for return trips. On the contrary, England will find it advantageous to come to us for our anthracite. A slow radiating fire without flame, is what is required, and this is best supplied by our anthracite. There being no smoke, a short pipe to carry off the carbonic oxide gas and other products of combustion is all that is needed. But the great advantage of this important improvement, and that which, in the absence of other advantages, would commend it to adoption, is the entire safety of the engine, an explosion being impossible. In steam engines, if the water gets low, or if there is an excess of pressure, or any defect in the materials of which the boiler is composed, or an overheating of the furnace tops, occasioned by incrustation formed by salt, in marine boilers, &c., an explosion is inevitable. But in the caloric engine the only result from neglect will be the stoppage of the engine. The present test engine shows that there must be a neglect to put in fuel for the space of three hours before the speed is even slackened. Thus you have nothing to fear from a sleepy engineer or an ambitious captain; and all the while not one-quarter the amount of attendance and labour required to keep a steam engine in motion will be needed. When we consider the amount of human mutilation, suffering, and loss which will be prevented for a century to come, when this invention shall have passed into general use, surely every philanthropist will bid God speed to this new motive engine. A caloric ship of 2,200 tons, to be called the *Ericsson*, is now in process of construction, and is in such a state of forwardness, that she will be in frames by the end of next week. She is a very beautiful model, and is the admiration of all shipbuilders for her remarkable strength, being admitted to have the strongest bottom of any ship built in New York. The machinery is more than half completed. I saw three, out of the four working cylinders, the paddle-wheels, all the valves and valve chests, the main links and connecting rods, the bed-plates, and main pillar blocks—and various other parts of the engine—all of them massive forms of metal, cast with the utmost precision and smoothness, and the castings pronounced by competent judges to be superior to the best in the British steamers. The cylinders are 168 inches in diameter, 72 inches larger than those in the Collins steamers. The *Ericsson* will be ready for sea by October next, and her owners intend

to take passengers at a reduced price in consequence of the reduced expenses under the new principle. The ship belongs to Mr. John B. Kitching and a few other wealthy men. The *Ericsson* will be commanded by Captain Lowber."

[We gave a full description of the caloric engine, with engravings, in our last volume, p. 41. The invention, as many of our readers will recollect, was made originally in this country, about eighteen years ago (see *Mech. Mag.*, vol. xx., p. 250), and then excited a good deal of notice. Mr. Ericsson favoured us at that time with a demonstration of the principle of it, which, for the sake of present readers, we now republish.]

To arrive at a clear understanding of the advantage gained by the new mode of employing heat adopted in this engine, it may not be amiss to pause for a moment to consider how heat is at present made use of when employed to actuate that universal instrument of mechanical power, the steam engine? Is it necessary *to the effect produced* that the heat should be absorbed or destroyed, or in any way diminished in energy? If this question can be answered in the negative, then it will be quite logical to assume that the power of the steam engine forms but a fraction of that which the combustion of a given quantity of fuel is capable of producing.

Well, then, let us suppose a quantity of steam, of known volume and pressure, to be admitted into a vessel containing cold water of a given weight and temperature, the elevation of temperature which will be produced will, of course, afford an accurate measure of the quantity of heat contained in the steam previous to its condensation. Suppose, now, that an equal volume of steam, of equal pressure, as in the first instance, is admitted, under a piston, working in a cylinder, and subjected to a proportionate load — that piston will, of course, move until all the steam has been admitted, and, by its motion, exert a force proportionate to the pressure of the steam and the volume displaced. Let, then, the steam be discharged from under the piston into the vessel of cold water, under similar circumstances as in the first supposition, and it will be found that the *same* elevation of temperature will take place as when the steam was not previously employed to raise the piston. We thus find that *the production of mechanical force by heat is unaccompanied by any loss of heat.**

But, in the steam engine, this remarkable circumstance is not productive of any advantage, for although nearly all the heat generated in the boiler is unquestionably conducted to the condenser, that heat cannot from thence be brought back to the boiler again for the purpose of raising steam, having in the condensing process been diffused amongst a large quantity of matter, and brought to a much lower temperature than the steam.*

On these grounds the inference seems incontestible, that the steam engine is not constructed on a correct physical principle, inasmuch as it consumes a greater quantity of that precious commodity, fuel, than is necessary for the production of the mechanical force obtained.

It is well known that all fluid substances, the gases particularly, expand very considerably by being exposed to the action of heat, and that, if kept in a state of compression previous to being heated, their expansive force will, at a given temperature, be greater, and that in the same proportion as the increase of density. That an engine might be worked by means of such expansion or dilatation, will be readily admitted by any one reflecting on the subject, without referring to the diagram or sketch of the Caloric Engine given in a recent number of your Magazine. I will, therefore, not detain your readers by detailing the manner in which the motion is practically produced by the dilatation of the heated medium, but confine myself to the theory of the contrivance, by which a nearly unlimited quantity of the impelling medium (gaseous or fluid) may be heated to any required temperature, by the consumption of a small quantity of fuel.†

Let fig. 1 (see the accompanying engraving) represent a furnace having a metal tube *y*, conducted through the centre of its flue, to be acted on by the heat in its passage to the chimney; let a pair of bellows be attached to the pipe *y* at A, for the purpose of keeping up a constant current of air through that pipe; and let a thermometer be inserted into it at A, and another thermometer at B.

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* Losses by radiation need not here be taken into account, for they do not affect the theory.

* Of course, every boiler is fed from the condenser, but this produces a saving of fuel of only one-thirteenth part of the whole quantity consumed—hence thirteen-fourteenths of the heat generated is constantly wasted.

† The journal cited in my last communication, having, by some strange oversight, mistaken the Caloric Engine for an "Air-Engine," it will be well to direct the attention of your readers to the fact that various gaseous and even fluid substances capable of considerable dilatation by heat, are equally applicable for using the heat over and over again; and for the reason that the *impelling agent may be varied*, while, in every case, *caloric is indispensable*, has the term *Caloric* Engine been chosen.

Now, suppose a regular fire to be kept up, and the bellows to be regularly worked so as to blow, say 20 cubic feet of cold air into the pipe *y* per minute: if it then be found that whilst the thermometer at A indicates 60° the thermometer at B will continue

Fig. 1.

to indicate 100°, it follows, as a matter of course, that the heat transmitted by the furnace per minute will be accurately ascertained by calculating what quantity of heat is required to raise 20 cubic feet of air from 60° up to 100°. Now, suppose the same fur-

nace, with its metal tube, to be represented by fig. 2, but instead of having the bellows attached to the metal tube, suppose them to be attached to a pipe, AC of infinite length, and let this pipe be inclosed in a casing X; suppose farther this casing to be surrounded by a perfect non-conductor of heat, and instead of allowing the hot air to pass off directly, as at B, in fig. 1, let it be conducted from the metal tube *y*, through the pipe D, into the casing X, and pass off at B. Then let thermometers be inserted in the pipes at A, C, D, and B, the bellows being worked at the same speed as before, and an equal fire kept up. At the commencement, the thermometer, at A and C, will of course both indicate 60°, but the thermometer at C will very soon begin to rise, on account of the heat conveyed into the casing X; but any increase of temperature at C, will of course cause an increase of temperature at D. This again will still further increase the temperature at C, and so on, in continued succession, until the thermometer at D indicates a temperature nearly equal to that of the hot air in the beginning of the flue leading from the furnace: any further increase of temperature of course cannot take place. Now, since the quantity, or rather weight of air forced through the metal tube *y*, is the same as in the first proposition, and the power of the fire likewise; this latter proposition, illustrated by fig. 2, incontrovertibly proves, that the *temperature* to which the air may be brought is made perfectly independent of the *quantity* of heat generated in the furnace.

But the *quantity* of air to be heated will also be equally independent of the *quantity* of heat generated: for suppose that in the first proposition the draught be checked so as to diminish the consumption of fuel three-fourths, then the 20 cubic feet of air constantly circulated per minute will be raised about 10° instead of 40°; but apply the contrivance for bringing the heat back, as illustrated in fig. 2, and the thermometers at C and at D will be effected just as above described, except that more time will be required before the temperature at D is brought to the full height, and that less heat will ultimately escape at B. Thus it may be proved *theoretically*, that any quantity of fluid air or gaseous matter can be heated up to a high temperature, independently of the quantity of heat actually generated for that purpose. Although this is apparently a paradox, it is not so; for by referring to the illustration in figs. 2 and 3, it will at once be seen that the circulating fluid is of a *high temperature only when passing the point* D, and that it gradually diminishes in temperature, as it recedes and gradually increases as it advances towards that point. However, for the purpose of obtaining mechanical force, this is quite as advantageous as if the fluid retained its high temperature when it escapes; for at the point D is the heated fluid admitted into the working cylinder, and from thence passed off into the casing X. The manner in which this is done, your diagram of the Caloric Engine, in a former Number, fully explains.

Fig. 3 represents the form of apparatus used in practice; its operation is precisely the same as in fig. 2, and thermometers placed at A, C, D, and B, will indicate temperatures, proving the increase of temperature and transfer of heat in a similar manner. The cold fluid is forced into the furnace through a number of small tubes Z, and the hot air is passed off through the vessel X (called the regenerator). The currents, both in this vessel and in the tubes, are broken in a peculiar manner, so as to produce a constant intermixture of particles, which is absolutely necessary for effecting a rapid transfer of heat. But to such an extent has this object been attained by the contrivances instituted, that hot air, constantly passed at the rate of 6 feet per second, through a pipe of 1½ inch bore, 14 feet long, and entering at a temperature of 300°, has, by a counter-current of *equal magnitude*, been brought down to 85°, the counter-current at the same time entering at 72°.

FUSIBLE METAL FIRE-PLUGS.

In No. 1500 of the *Mech. Mag.*, it appears that Mr. Granville Sharp, in his Prize Essay, has suggested, amongst other modes of constructing safes for the protection of valuable articles from fire, that is, fireproof receptacles, of the same nature with those proposed in the *Builder* of 4th December, 1847, but without reference to that publication. So also he recommends the use of *fusible metal* to ensure a self-acting flow of water; but in this instance he speaks of it as "Mr. Mackay's invention;" was it so, or was it not? Had Mr. Mackay in any way recorded his invention previously to December, 1847? Had he recorded it before 27th October, 1849, when "M. S. B.'s" paper appeared in the *Mech. Mag.*, recommending portions of pipes of fusible metal for rendering a fire-extinguishing apparatus automatic? It often happens that, having the same object in view, different persons devise similar means of attaining it.

The article in question, as given by the *Builder*, was as follows:

"*Fireproof Safes.*"

"An obliging correspondent writes as follows:

"Property to an immense amount, in title-deeds, foreign securities, &c., is now incapable of insurance from fire, on account of the excessive risk such articles are exposed to. A receptacle for articles of this nature has been devised which would afford for them perfect security from conflagration, and which might be constructed at an expense so moderate as might enable private persons to adopt it; bankers, for instance, who usually hold in trust securities of very considerable value. It has been planned from a combination of the several expedients devised, and successfully introduced, by the late Sir Samuel Bentham, whilst Inspector-general of Naval Works, for the protection of the Royal Dockyards from fire, for the conservation of gunpowder in case of fire on board ship, and for giving light to ships' powder-magazines.

"The proposed receptacles may be briefly described as follows:

"Where it can be constructed under ground, a chamber, of which the walls, floor, and roof should be made perfectly water-tight; a cistern of water covering the roof.

"The interior of the chamber either to be fitted up with a number of cells of metal, capable of being closed water-tight; or with separate moveable water-tight cases, the cells or cases being for the reception of the property to be secured against fire, these cells or cases being arranged in the middle of the receptacle, so as to leave a clear space between them, the walls, and the roof.

"Pipes communicating with the interior of the receptacle to be conveyed from the cistern, by which means, in case of danger from fire, water to be let into the receptacle itself, so as to fill it completely round and above the water-tight cells or cases. The cistern to contain a quantity of water more than sufficient to fill the interior of the receptacle, and means to be provided for replenishing the cistern in case of evaporation or other loss of water.

"To render the flow of water into the receptacle *self-acting*, in case of fire, the pipes of communication to be plugged with *fusible metal*:* thus, should a neighbouring conflagration be such as to raise the water in the cistern to a boiling heat, the plugs would melt; consequently water would enter from the cistern to the receptacle, fill it, and preserve intact the contents of the cells and cases. After the danger ceased, the water would, of course, be pumped out of the receptacle.

"The entrance would be most securely made through the roof and cistern above, by means of a cased trap-door closing water-tight, so as when not in use to be covered with water.

"For giving light when needful to the interior of the receptacle, safety-lamps, encompassed by a double casing of glass, filled between with water; the pipes for supplying air and for conveying away the foul air, to be siphon-shaped, so contrived that no sparks could issue from them.

"Where such a receptacle could not be conveniently constructed under ground, the wall to be inclosed in an exterior one at some distance from it; the interval to form a cistern filled with water, easily replenished like the cistern on the roof.

"To dry and ventilate the receptacle, a ventilator; such, for instance, as that proposed by Dr. Hales, a century ago, might be used; that is, a kind of wooden air-pump of very simple construction; means being at the same time provided to supply the place of moist air contracted by other air drawn from a chamber where it would be already dried and warmed.

"As gunpowder, whether in bulk or in cartridges, was found to keep perfectly in Sir Samuel's water-tight cases, there can be no doubt but that parchments or papers might be equally well preserved in a suitable cell or case, supposing always that they were dry when inserted." Thus ends the *Builder's* article.

On the occasion, not many years ago, of a fire in Lincoln's-inn, and when some occupants of chambers were in consequence about to construct private safes for the security of papers intrusted to them, the same correspondent of the *Builder* ventured to suggest (privately)

* See No. 1475, page 391, of the *Mech. Mag.*, for various applications, by the same correspondent, of fusible metal to pipes, spreaders, &c.

the construction of a capacious fire-proof safe for general use. It was observed in this suggestion, that the great square of the inn afforded ample space for an underground safe; that the same plan, generally speaking, as that indicated in the *Builder* would be applicable; that more or less share in the interior of the safe might be let to individual residents of the inn; that the deposit or withdrawal of a case, on written demand, from its owner, might be safely intrusted to a responsible individual; that this person might be chosen in such manner as to satisfy depositors of his competency for this service; that a remunerative rent might be obtained for the same,—yet fixing the charge for share in its interior at a much lower rate than equal security could be obtained for in any private safe.

It would seem that insurance-offices, by means of such safes might be enabled to insure many deeds, securities, and other papers against fire, especially those not frequently wanted; those necessary for the receipt of dividends on foreign stocks would require to be produced half-yearly, though deeds of many descriptions would be wanted only on the occasion of sale or transfer of an estate. A premium would, of course, be demanded equal to the extra expense of storing property of this description, and of delivering it upon occasions when it might be wanted.—How many are the persons who would gladly embrace an opportunity of insuring that fragile paper or parchment on which, perhaps, their whole means of subsistence depends!

The first known occasion on which fusible metal was applied to use was in the year 1796 and 1797, when Bentham employed it as a safety-valve to the cooking and distilling apparatus of the *Arrow*. In No. 1429 of the *Mechanics' Magazine* will be found his application of it as a calorimeter.

M. S. B.

THE PADDLE-WHEEL AND SCREW.

It has frequently been stated that high speed cannot be obtained with a screw propeller, and an instance challenged where speed has been given by it to a large vessel, equal to the speeds obtained from fast ocean steam-ships, like the Collins and Cunard liners; but I think the results furnished from the *City of Pittsburg*,* a vessel probably of equal resistance to the steamers of these celebrated lines, will be found as high, comparing them with the actual powers applied to the propelling instruments.

With the Collins' steamers there is required, to make a ten days twenty hours passage from New York to Liverpool, a mean effective steam pressure of 19 lbs. per square inch of piston, furnished by a consumption of 83 tons of coal per twenty-four hours, cutting off at four-ninths. The space displacement of both pistons per stroke is 888·03 cubic feet. Mean number of double strokes per minute, 14½. Allowing, then, the mean effective pressure in the cylinders of the *City of Pittsburg* to be 19 lbs. per square inch, and the double strokes of piston per minute 43·18, the powers and results would compare as follows; viz.,

	Powers.	Speeds.	Cube of Speeds or Results.
Collins	1·115	1·039	1·122
City of Pittsburg	1·000	1·000	1·000

The foregoing is, of course, but an approximation obtained from general data; but it is sufficiently close to demonstrate that the screw will, for ocean steam-ships of very deep draft, give equal speeds with equal power, compared to the paddle wheel, provided it be properly proportioned and well managed.

The screw has never, to my knowledge, been tried in a first-class ocean steam-ship, with any approximation to the power that is applied to the paddle-wheels of such vessels; of course, the reason is obvious why as great speeds have not been obtained.

General Proportions of Power and of Surface of Screw to Immersed Amidship Section of Vessel.

Square feet of immersed amidship section of vessel per cubic foot of space displacement of pistons ..	2·992 to 1·000
Square feet of immersed amidship section of vessel per cubic foot of space displacement of pistons multiplied by number of double strokes of piston per minute	0·093 ,,
Square feet of immersed, &c., per square foot of area of screw, viewed as a disc ..	7·240 ,,
Square feet of immersed, &c., per actual horse power developed by vessel	1·030 ,,

B. F. Isherwood, Chief Engineer, U.S.N.
—*Franklin Journal.*

* A new steam ship, which has recently begun to run between Philadelphia and Liverpool.

ELECTRIC TELEGRAPH BETWEEN ENGLAND AND IRELAND.

A submarine telegraph between the coasts of England and Ireland is now an accomplished fact. The parties to whom the honour is due of solving this great practical problem (there have been no less than three in the field), are those who are associated under the title of the *Irish Electric Telegraph Company;* and the cable used for the purpose has been manufactured for that Company by the same eminent firm which supplied that for the Dover and Calais line—Messrs. Newall, Milnes, and Gordon, of Newcastle-on-Tyne.

Last Tuesday morning, at 4 o'clock, the *Britannia* steamer started from Holyhead with the cable on board, stated to weigh about 110 tons, preceded by Her Majesty's steamer *Prospero*—a vessel furnished by the Admiralty as a pilot to the expedition. The steamers proceeded at a low rate of speed, varying from four to six miles an hour, paying out the wire with the greatest care and precision as they receded from the English coast; and at length, after a passage of little more than 16 hours, and without the occurrence of any *contretemps*, arrived at Howth Harbour amid the cheers of those who had assembled to witness their approach. The moment the *Britannia* had arrived at her destination, and communicated the fact to Holyhead that the Irish shore was reached, the final grand test was applied to the telegraphic cable by connecting the wire with one of the ship's loaded guns, and passing the word "Fire!" to Holyhead. The answer was the immediate discharge of the gun on board the *Britannia*. The hour was then just half-past 8 o'clock. The work had been performed in little more than 18 hours! Messages were now rapidly interchanged, and a salute of the *Britannia's* guns fired from Holyhead. Another hour, and the cable was ashore, the connection completed with the land wires, and the indicators at the Dublin terminus of the Drogheda Railway, in Amiens-street, were conversing with those at the terminus of the Chester and Holyhead Railway, in Holyhead.

The cable is not composed of four wires, like the one from Dover to Calais, but consists of a single copper wire, perfectly insulated with gutta percha, and protected by an outer covering of iron galvanized wires. In order to secure the cable from injury by the tides and the sharp rocks, it has a double covering of iron wires from each shore for some considerable distance into the sea. The double covering of the 70 miles of wire with gutta percha was done by the Gutta Percha Company, at their works, in Wharf-road, City-road; it was then shipped to Gateshead, where the task of adding the iron galvanized wires was performed by Messrs. Newall and Co.

SILESIAN IRON.

(From notice in the *Times* of the Silesian Exhibition of Arts and Manufactures.)

The most extensive display of iron, in all the stages of its manufacture, is sent from the numerous forges or *Hutten* of Count Renard, who alone occupies a large portion of the basement of the building. The quality of the metal produced at his works has secured it a local reputation, though other establishments, as the Laura Works, at Beuthen, produce iron in bar and the larger forms in greater quantity. The Renard Works are unrivalled in the finer sorts, and of hoop iron, nail-rods, wire, cast iron for cooking vessels, steel in many varieties, especially forged steel of the finest quality, there is a most abundant supply. Sheet iron is exhibited from these works of such a degree of tenuity that the leaves can be used for paper. A bookbinder of Breslau has made an album of nothing else, the pages of which turn as flexibly as the finest fabric of linen rags. As yet no extensive application for this form of the metal has been found, but the manager says the material must precede the use for it; perhaps books may hereafter be printed for the tropics on these metallic leaves, and defy the destructive power of ants of any colour or strength of forceps. We have only to invent a white ink, and the thing is done. Of the finest sort the machinery rolls 7,040 square feet of what may be called leaf iron from a cwt. of metal. In point of price, however, the Silesian iron cannot compete with English; much is still smelted with wood, and the coal and iron districts lie at great distances from each, so that much capital is consumed by the conveyance of fuel to the works.

H. M. S. "EDINBURGH."

On Tuesday last, Her Majesty's ship *Edinburgh*, 74 guns, went out of Portsmouth Harbour to Spithead and Stokes's Bay, to try her engines and speed at the measured mile.

This ship has been recently fitted with engines of 450 horses power and screw propeller, by Messrs. Maudslay, Sons, and Field. Her performance was in every respect satisfactory; the engines worked admirably, and the speed attained on the average of four trials was not less than 8·9

knots, or nearly 9 knots per hour, which was more than was expected from so large and deep a ship.

The engines and boilers are placed so low in the ship that the highest part is seven or eight feet below the water-line; so that the efficacy of the machinery could not be injured by shot passing through the vessel.

The *Edinburgh* has been lately commissioned by Captain Hewlet, who was on board at the trial, accompanied by Captain Chad, of the *Excellent*, and Captain Henderson, of the *Blenheim;* Mr. Murray, Chief Engineer of Her Majesty's Dockyard; Mr. Lambert; and Messrs. Maudslay and Field, the makers of the machinery. The ship returned into the harbour by 4½ P.M., although the wind was blowing strong.

A RAILROAD OVER ICE.

(From the *Franklin Journal.*)

The railroad lately laid upon a graduation of ice, provided by nature across the mouth of the Susquehanna river, at Havre de Grace, in the State of Maryland, seems to deserve a more permanent record than the fleeting notices of the daily press.

It adds another to the many striking evidences recently afforded of the promptitude with which the mind of the American engineer and mechanic grapples with unexpected difficulties, and triumphs over them.

The railroad uniting the cities of Baltimore and Philadelphia, touches both banks of the Susquehanna river at its mouth.

The river here is about four-fifths of a mile in width, and forming a break in the railroad of that length, over deep water; the communication is usually kept up by means of a large steam ferry-boat, upon which the passengers cross from one bank to the other, independent trains with their locomotives being in waiting upon both banks.

The passengers themselves debark, when they reach the river, and gain the boat through covered buildings, which screen them from the weather; their baggage, with the car containing it, is run upon the upper deck, and being carried over, is replaced upon the railroad on the further bank, and coupled to the train in waiting there.

Now the river Susquehanna, leading to the north, in bleak and mountainous regions, brings down in the winter seasons great quantities of floating ice, which seriously impede the railroad ferry.

At the mouth of the river there is shoal water, in which the ice grounds, and in severe weather it forms a point of support for successive floating masses, until it sometimes gorges up for many miles above the ferry of the railway line.

In forming these "*gorges*" of ice, the cakes edge up, and freezing together in that position, form a mass of great solidity and strength, but very rough upon the surface.

While this gorge is forming, the railroad ferry is necessarily discontinued, and when it has formed, the question arises—how is the business of the railway to be resumed?

These preliminary remarks bring us now to our main subject. In a severe winter like that of 1851-2, the engineer of the railway sees his ferry line at Havre de Grace cut off, and the river filled almost to the bottom with a vast accumulation of cakes of ice, a foot thick, edged up, and frozen in that position, so as to present a mass of great strength, but most forbidding superficial aspect.

Contemplating this with the true eye of science, and seeing its adaptation to his purpose, Mr. Trimble, the Engineer of the Railroad Company, determined to form over this rude glacier *a railroad* for his baggage and freight cars, and *a sledge road* alongside of it, upon which two-horse sleighs could carry his passengers, and by means of towing lines, propel the freight cars over the river. This was the great idea, and most promptly and successfully has it been carried out.

The first step was to *locate* the railroad; for upon this rough surface of ice, a straight line between the ferry landings, would have required too much graduation,—too much excavation and embankment, so to speak, of ice and snow.

The line was accordingly staked out with several curves, so as to reduce the labour required in grading the frozen surface; the projections, points, and ridges were cut away, and broken fragments of ice were used to fill up the hollows. Then upon condemned ties about four feet apart, with some new timber interspersed, a track was laid with U rails, of about 40lbs. to the yard, confined merely by hook-headed spikes, and without chairs.

The surface of the ice being some 10 or 15 feet below the permanent rails upon the two banks, was gained by temporary inclines, running off from the shores upon a rough blocking of cob work, so arranged as to be adjustable, and taking advantage of a low pier on the left bank, to reduce the grade. These inclines, and the track across the ice, were connected with the main line on both banks, by suitable switches, and formed, in fact, a species of sideling nearly a mile long. Upon the inclines the baggage and freight cars were worked one way by *gravity*, and the other by *roping*, from the locomotive train. Forty freight cars per day, laden with valuable merchandise, have been worked over this novel tract by the

means above referred to, and were propelled across the ice portion by two-horse sleds running upon the *sledge road*, and drawing the cars by a lateral towing line, of the size of a man's finger.

At the present writing, this novel and effectual means of maintaining the communication at Havre de Grace is still in successful operation, and will so continue until the ice in the river is about to break up. Then, by means of the sledges, the rails (the only valuable part of the track), can be rapidly moved off by horse power, not probably requiring more than a few hours' time, so that the communication may be maintained successfully until the last moment. If properly timed, as it doubtless will be, the railroad may be removed, the ice may run out, and the ferry be resumed, it may be, in less than forty-eight hours.

We cannot conclude this brief notice by an eye-witness, without expressing our admiration of the ingenious practical arrangement, adopted for overcoming an extraordinary difficulty at this point, by Isaac R. Trimble, Esq., the Engineer of the Railroad Company.

VICE-CHANCELLOR'S COURT.—*Monday, May* 31.

(Before Sir G. TURNER.)

The Vulcanised Caoutchouc.

HANCOCK v. MOULTON.

Sir W. P. Wood, Mr. Hindmarch, and Mr. Southgate, were heard in opposition to a motion for the injunction to restrain the infringement of the plaintiff's patent,* which, it is asserted, takes place in the caoutchouc manufactory of the defendant at Bradford. They contended, on the part of the defendant, that the motion should be refused on several grounds; first, that there was no novelty in the invention for which the plaintiff Hancock obtained a patent. The affidavits showed that articles of caoutchouc prepared in the manner to which the plaintiffs had given the name of vulcanisation,—a name which was adopted to conceal the ignorance which existed of the real nature of the change effected in the substance; the affidavits showed that such articles had been exhibited, not merely for the purpose of obtaining a patent—not for the purpose of obtaining pecuniary assistance in perfecting that invention, or the title, which might be legitimate purposes for making known the invention—but that such articles had actually been exhibited for the purpose of obtaining orders as early as the year 1843 or 1844. This was such a publication as would prevent any party from afterwards obtaining a patent; secondly, they contended that the patent had never been established by any legal proceedings. The plaintiffs had, indeed, proceeded against some importers of India-rubber goloshes, and had succeeded. Such were the actions against Somerville and Birt, on which the plaintiffs relied; but, in the first place, the goods then complained of were made by a process in which crude sulphur was introduced; and, secondly, those actions were merely attempts to establish a patent behind the back of the parties chiefly interested, against persons who were only vendors, and were not inclined to prosecute their defence to the claim; thirdly, they denied the alleged infringement. The plaintiffs relied entirely on the use of sulphur. The defendant did not use sulphur. It was true a small portion of sulphur might be extracted upon analysis; but the basis was hyposulphite of lead—it was a compound of sulphurous acid and lead. Sulphur was not introduced. It was as reasonable to say that Epsom salts were sulphur. If the article to be manufactured was intended to be elastic, the defendant effected the process by the use of hyposulphite of lead and artificial sulphuret of lead, both or either, but he preferred to use them in equal quantities. If the article was intended to be hard, and not elastic, the defendant introduced carbonate of magnesia. It was probably the case that the oxygen of the sulphuric acid combined with the lead, and gave off a small portion of sulphur in a free state, but it was entirely an assumption to say that therefore the sulphur produced the result which they called vulcanisation. The defendant, and the affidavits on his behalf, showed that it was the lead, in chemical combination with the other ingredients, which produced the result. It was not true that 1½ per cent. of sulphur was sufficient for the purpose in the plaintiffs' manner of preparation, for the defendant had caused a portion of the rubber produced by the plaintiffs, as exhibiting vulcanisation by that proportion of sulphur, to be exposed to the action of turpentine since Saturday (May 29th), and it has already become gelatinous. It was quite clear that the alleged infringement by the use of the hyposulphite of lead had never been the subject of any trial at law, and therefore the Court would not grant the injunction without a trial. And, lastly, they contended that the Court could not interfere in any view of the case by injunction, for the plaintiff had been distinctly informed two years and a half ago that the defendant intended forthwith to manufacture caoutchouc according to his patent, which disclosed the full process;

* For a full account of this patent, see *Mech. Mag.* vol. xlii., p. 150.

the defendant had expended 3,000*l.* upon his works, and acquired a large business by his exertions, without any notice that his right was to be challenged; his patent had remained several years without any attempt to attack it by *scire facias*; it was even several months ago that the trial at law upon which the plaintiffs relied had taken place. After these laches and acquiescence the plaintiffs had lost all right to the interposition of the Court, even if they ever had such a right, and the Court would therefore refuse the motion.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JUNE 3, 1852.

WILLIAM ARMAND MOREAU GILBEE, of South-street, Finsbury, gentleman. *For certain improvements in the process of, and apparatus for treating fatty and oleaginous matters, and in the manufacture of candles and other useful articles therefrom.* (A communication.) Patent dated November 22, 1851.

Claims.—1. The application of sulphurous acid to the direct acidification of neutral fatty bodies.

2. The mixture of a sulphite with a calcareous soap before its decomposition by means of sulphuric acid, especially when the latter contains azotous acids.

3. The application of sulphurous acid gas during the production of calcareous soap.

4. The heating of distilling apparatus by means of the circulation of a liquid carried to a high temperature in tubes, or by means of over-heated steam circulating in an envelope surrounding the bottom of the still, and then injected within the distilling fatty body.

5. Two processes for super-heating steam in metallic baths.

6. The application of a new construction of pyrometer to apparatus for distilling fatty bodies.

7. A process of extracting paraffine [from peat, schistus, &c.,] and of purifying the same [by the aid of oleic acid].

8. A mode of operating and applying the liquid extracted from cocoa-nut oil.

9. A mode of treating castor and "ricinous" oils, and their transformation — 1, Into sebacic acid to be mixed with candles; 2, Into a new alcohol; and 3, Into a new fatty acid.

10. A mode of heating the moulds of luminaries.

11. A peculiar construction of candle-mould frame.

12. An apparatus for unmoulding candles.

13. Four apparatuses and processes, whether used in combination or singly, for treating fatty and oleaginous matters, together with certain new combinations of chemical agents.

14. The application of argillaceous and other similar earths in the treatment of fatty and oleaginous bodies.

JEAN BAPTISTE CHALMIN, of Rouen, merchant. *For improvements in preparing and weaving cotton.* Patent dated November 22, 1851.

These improvements consist in preparing cotton warp and weft by sizing the same previous to weaving with certain new compositions, and in dressing the fabrics made therefrom by the application of heat during the process of weaving, whereby fabrics are produced from cotton yarns possessing all the gloss and durability of linen.

The warp and weft to be prepared by the patentee's processes are to be previously bleached, as after being so prepared they are brought to a state that resists the action of the ordinary bleaching agents. The size for the warp is composed of 32 lbs. starch, 32 lbs. wheat flour, 23 lbs. potato flour, 3 oz. bleached bees' wax, 2¾ lbs. sulphate of zinc, and half a pound sulphate of copper in crystals, brought to a state of solution by heating them in a suitable vessel with 700 pints of water. This quantity of solution is sufficient for 4 cwt. of warp. The warp is immersed in the solution, and submitted to pressure, to cause it to be perfectly impregnated, after which it is dried, and is then fit for use. The size for the weft is composed of 66 lbs. starch and 66 lbs. potato flour, brought to a state of thin paste with 845 quarts of water. This quantity is calculated for preparing 400 lbs. weight of weft, which is impregnated with it by immersion and pressure. The weft, after being prepared and dried, becomes as hard as wood, and may then be kept for any length of time without risk of deterioration. In order to render it fit to be woven, when it must be in a damp state, it is only necessary to soak it for about five minutes in warm soap and water. A solution for this purpose is composed by dissolving 13 ozs. of soap in 17 quarts of water.

The weaving may be performed in a hand or power loom, and the dressing of the fabric is effected simultaneously with its production, by substituting for the breast beam of the loom a tube or cylinder of metal heated by steam, and causing the woven fabric to be brought into close contact therewith; or the steam pipe may be carried along the front of the loom, and the fabric be brought in contact with it, as before. In order to dry the fabric produced as above, the patentee causes it to pass around steam-heated cylinders until the drying operation is nearly

completed, when he transfers it to the ordinary drying-room, and then finishes the process.

Claims.—1. The preparation of a solution for sizing cotton warp and weft, as described.

2. The application of a heating apparatus to hand and power looms for dressing and weaving simultaneously the said cotton warp and weft so prepared, thereby producing a fabric having the qualities and appearance of linen.

Frederick Benjamin Geithner, of Camden-street, Birmingham. *For improvements in the manufacture of castors and legs of furniture.* Patent dated November 22, 1851.

The "improvements in the manufacture of castors" consist in constructing the rollers of the same of china, porcelain, or earthenware, by forming plastic materials to the desired shape, and then firing, and ornamenting, and glazing the same; or by employing the materials in a pulverized or disintegrated state, and submitting them to pressure in moulds of the required shape, and subsequently painting or ornamenting and glazing the same; or the rollers may be composed of metal having discs of china, porcelain, or earthenware, let into the sides thereof, and retained in place by burnishing down the edges of the metal over the discs, which may be painted or ornamented so as to give an improved appearance to the castors.

With regard to the "legs of furniture," the improvements consist in manufacturing the same from china, porcelain, or earthenware, so as to have castors combined therewith. The legs are formed hollow, and the castors are attached to spindles, which run through the whole length of the legs, and are screwed at their upper ends to enable them to be attached to the piece of furniture to be supported. The whole weight of the furniture is thus borne on the spindles of the castors, the china or earthenware exterior legs serving merely for the purpose of ornament.

Claims.—1. The manufacturing of rollers for castors by moulding or forming them of plastic or dry materials as described; and the manner of filling up the sides with suitable discs.

2. The forming of the legs of furniture of china and earthenware in such manner as to have castors combined therewith.

Alexander Southwood Stocker, of Wandsworth, gentleman. *For certain improvements in the stoppering or stopping of bottles, jars, pots, or other such like receptacles.* Patent dated November 25, 1851.

This invention is stated to consist,

1. In lining metal or other capsules or covers for bottles, jars, pots, or such like receptacles with cork or other suitable materials, so as to make the capsules or covers to fit closely around the outside of the neck or part to which they are applied.

2. In closing or filling up the opening or crevice around the neck of a bottle or other vessel, and between it and its cover or stopper, by means of a washer or ring of vulcanised India-rubber or other suitable material.

3. In manufacturing stoppers for bottles, jars, &c., by fixing the upper ends of plugs of cork, or other suitable material, into capsules or covers of glass, porcelain, metal, or other material, in such manner that the said plugs may fit closely against the interior of the rims of the said capsules or covers.

4. In covering over, or closing the opening or crevice around the neck of a bottle or other vessel, and between it and its stopper or cover, with a ring or band of vulcanised India rubber, or other suitable elastic material.

5. In securing covers to bottles or other vessels by means of pairs of wires, or substitutes for wires, hinged to the covers, one such wire being a loop which fits into a groove around the neck of the bottle, and likewise forms a projection or staple, and the other acting as a catch or hasp which fits over the projection or staple of the former one.

Richard Whytock, of Edinburgh. *For improvements in applying colours to yarns or threads, and in weaving or producing fabrics when coloured or party-coloured yarns or threads are employed.* Patent dated November 27, 1851.

The "improvements in applying colours to yarns or threads" consist in an arrangement for superseding the use of the travelling colour-box, employed in conjunction with a colour-roller, for printing one or more threads.

The "improvements in weaving or producing fabrics when coloured or party-coloured yarns or threads are employed," consist, firstly—In the use of such coloured or party-coloured threads or yarns for forming sprigs or patterns on ribbons or other narrow fabrics; and, secondly—In the application of magnetic power for impelling the small shuttles employed for throwing in such coloured threads in the formation of sprigs, and for other purposes where a small extent of travel only of the shuttle is required.

Henry Ellwood, of the firm of J. Ellwood and Son, of Great Charlotte-street, Blackfriars, hat-manufacturers. *For improvements in the manufacture of hats.* Patent dated November 27, 1851.

These improvements consist in manufac-

turing hats of every variety—whether for ordinary or military wear—with a double body. The object of this arrangement is to prevent the full heat of the sun in tropical climates being transmitted to the head of the wearer through the hat; and the space between the bodies serves to contain air, by which much of the heat is intercepted. To keep the head cool more effectually, the patentee proposes to form apertures in the side of the exterior, to admit of a free circulation of air through the space between the hat bodies. The interior body, or that immediately in contact with the head, is formed of a shape to fit almost closely, while the exterior body is fashioned according to the class of hat required—taking care in every case to make the two bodies as light as possible.

Claim.—The manufacture of hats as described.

JOHN LEE STEVENS, of Kennington, gentleman. *For certain improvements in propelling vessels on water.* Patent dated November 27, 1851.

These improvements consist in constructing paddle-wheels in which the float boards are set in a diagonal position, in such manner that the ends of the float boards on each side of the wheel shall alternately project beyond, and overlap the ends of the next succeeding float boards; leaving, however, spaces between the nearest adjoining ends of the float boards. The angle of divergence from parallelism with the axle of the wheel which the patentee prefers the float boards to make is from 23° to 30°, and the distance between the float boards is so regulated that the greater interval between the ends of the float board shall be on one side of the wheel from three to four times as much as the lesser interval between the ends of the float boards on the opposite side of the wheel.

Claim. — The construction of paddle wheels with diagonal float boards so fixed and arranged that the alternate float boards overlap or project beyond the ends of the next float boards on either side of the wheel, leaving spaces between the succeeding float boards at either end thereof.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Adolphus Charles Von Herz, of Cecil-street, Middlesex, esquire, for improvements in treating, preparing, and preserving roots and plants, in extracting saccharine and other juices from roots and plants, in the treatment of such juices, and in the processes, machinery, and apparatus employed therein. May 29; six months.

Frederick Miller, of Fenchurch-street, London, gentleman, for improvements in apparatus for hatching eggs. May 29; six months.

Joseph Lees, the younger, of Manchester, calico printer, for an improved system of preparing, cutting, and engraving rollers to be used for printing woven and other fabrics, and improved machinery for printing and washing the same fabrics. May 29; six months.

Alexander Bain, of Beaver Lodge, Hammersmith, gentleman, for improvements in electric telegraphs and in electric clocks and time-keepers, and in apparatus connected therewith. May 29; six months.

William Septimus Losh, of Wreay Sykes, near Carlisle, gentleman, for improvements in the purification of coal gas. May 29; six months.

Richard Ford Sturges, of Birmingham, manufacturer, for certain new or improved ornamental fabrics. May 29; six months.

William Armand Gilbee, of South-street, Finsbury, Middlesex, for certain improvements in machinery for cutting corks. June 1; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in machinery for propelling vessels, and in apparatus to be used in connection therewith. (Being a communication.) June 1; six months.

William Henry Phillips, of Camberwell New-road, Surrey, engineer, for improvements in decorative illumination, and in applying light for other purposes. June 1; six months.

Thomas Willis, of Manchester, machine maker, for certain improvements in machinery or apparatus for winding yarns or threads, and also improvements in looms for weaving. June 1; six months.

LIST OF SCOTCH PATENTS FROM 22ND OF APRIL TO THE 22ND OF MAY, 1852.

Matthew Urlwin Sears, of Burton-crescent, St. Pancras, Middlesex, commission agent, for the improved construction of guns and cannons and manufacture of cartridges for the boring and charging thereof. April 26; six months.

Thomas Bell, of Don Alkali Works, South Shields, for improvements in the manufacture of sulphuric acid. April 28; six months.

Stewart M'Glashen, of Edinburgh, Scotland, sculptor, for the application of certain mechanical powers to lifting, removing, and preserving houses, trees, and other bodies. April 28; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for preventing the incrustation of steam boilers, which incrustation is also applicable to the preservation of metals and wood. (Communication.) April 28; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the method of manufacturing, and in machinery to be used in the manufacture of wood screws, part of which improvements is applicable to the arranging and feeding of pins, and other like articles; and also improvements in assorting screws, pins, and other articles of various sizes. (Communication.) April 30; six months.

George Frederick Muntz, jun., of Birmingham, for improvements in the manufacture of metal tubes. May 3; six months.

William Gillespie, of Torbane Hill, Linlithgow, Scotland, gentleman, for an improved apparatus, instrument, or means for ascertaining or setting off the slope or level of drains, banks, inclines, or works of any description, whether natural or artificial, or under land or water. May 5; six months.

William Thomas, of Exe Island, Devonshire, engineer, for certain improvements in the construction of apparatus and machinery for economising fuel in the generation of steam, and in machinery for propelling on land or water. May 5; six months.

Julian Bernard, of Guildford-street, Russell-square, Middlesex, gentleman, for improvements in the manufacture of leather or dressed skins, of materials to be used in lieu thereof, of boots and shoes, and in materials, machinery, and apparatus connected with, or to be employed in such manufacture. May 10; six months.

John Campbell, of Bowfield, Renfrew, North Britain, bleacher, for improvements in the manufacture and treatment or finishing of textile fabrics

and materials, and in the machinery or apparatus used therein. May 10; six months.

Richard Christopher Mansell, Ashford, Kent, for improvements in the construction of railways, in railway rolling stock, and in the machinery for manufacturing the same. May 10; six months.

George Leopold Ludwig Kufahl, of Christopher-street, Finsbury-square, London, engineer, for improvements in fire arms. May 11; six months.

David Dick, of Paisley, Renfrew, North Britain, machine maker, for improvements in the manufacture and treatment or finishing of textile fabrics and materials. May 11; six months.

Charles Ewing, of Bodorgan, Anglesea, steward and gardener, for an improved method or methods of construction, applicable to architectural and horticultural purposes. May 11; six months.

Anthony Granara, of Leicester-place, Leicester-square, Middlesex, hotel keeper, for an improved apparatus for lubricating machinery. May 14; four months.

Clemence Augustus Kurtz, of Manchester, Lancaster, manufacturing chemist, for an improvement in all preparations, of every description of madder roots and ground madder, in and from whatever country the same are produced; also in munjeet, in the root and stem from whatever country. May 17; six months.

William Watt, of Glasgow, Lanark, North Britain, manufacturing chemist, for improvements in the treatment and preparation of flax or other fibrous substances. May 17; six months.

Peter Fairbairn, of Leeds, York, machinist, and Peter Swires Horsman, of Leeds aforesaid, flax-spinner, for certain improvements in the process of preparing flax and hemp for the purposes of heckling; and also machinery for heckling flax, hemp, china grass, and other vegetable fibrous substances. May 17; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in the manufacture of coke, and in the application of the gaseous products arising therefrom to useful purposes. May 19; six months.

LIST OF IRISH PATENTS FROM 21ST OF APRIL TO THE 19TH OF MAY, 1852.

Joseph Pimlott Oates, of Lichfield, Stafford, surgeon, for certain improvements in machinery for manufacturing bricks, tiles, quarries, drain pipes, and such other articles as are or may be made of clay or other plastic substance. May 4.

George Torr, of the Chemical Works, Frimley-lane, Rotherhithe, animal charcoal burner, for improvements in the burning animal charcoal. May 17.

James Pillans Wilson, and George Fergusson Wilson, both of Wandsworth, Surrey, gentlemen, for improvements in the preparation of wool, for the manufacture of woollen and other fabrics, and in the process of obtaining materials to be used for that purpose. (Being partly a communication.) May 17.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register	Proprietors' Names.	Addresses.	Subjects of Design.
May 28	3272	W. Welby	Bermondsey	Life buoy.
,,	3273	T. F. Griffiths	Birmingham	Letter box.
,,	3274	J. Tuke	Doncaster	Water-closet.
June 1	3275	Henry Maling	Home-office	Form of rifling for fire arms.
,,	3276	L. Stubbs & T. Fleming	Birmingham	Nail or screw.
,,	3277	Robert Adams	King William-street	Balls or projectiles.
2	3278	F. Brampton	Birmingham	Music folio, or leaf-holder.
,,	3279	Wagstaff and Co.	Mark-lane	Portable candle-lamp.
3	3280	T. A. Readwin	Winchester-buildings	Self-acting currycomb.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

May 21	321	F. P. Rovère	New-Inn	Mars bullet-mould.
29	322	M. P. P. Brouillet	Finsbury	Self-adjusting candle shade.
,,	323	J. A. Donaldson	Poland-street	Fan-shaped window blind.

CONTENTS OF THIS NUMBER.

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Edited by J. C. Robertson, 166, Fleet-street.

THE OGDEN AND ERICSSON SOUNDING INSTRUMENT IMPROVED.

Fig. 1.

Fig. 2.

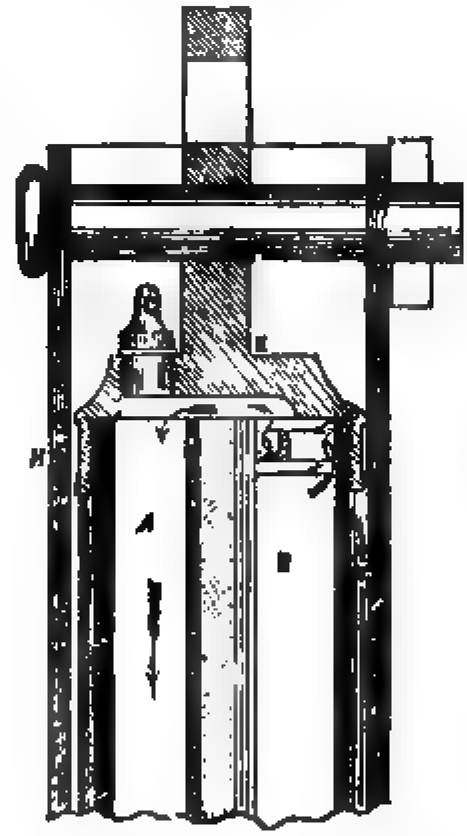
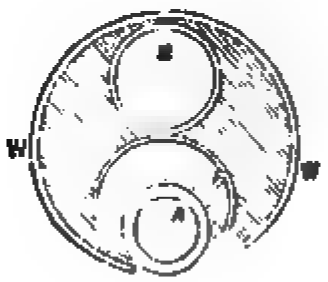
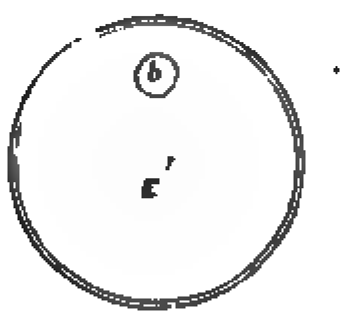


Fig. 3.





THE OGDEN AND ERICSSON SOUNDING INSTRUMENT IMPROVED.

It is now about twelve years, since Captain Ericsson, in conjunction with Mr. F. B. Ogden, then American Consul at Liverpool (recently transferred to Manchester), invented a sounding instrument which has acquired considerable repute, both among English and American seamen. The Commander of H. M. S. *Partridge*, who was appointed by our Lords of the Admiralty to make a trial of it in the Atlantic, reported that he had put the instrument to a complete practical test, by using it every second hour by day and by night for nine days, beginning with a depth of 5, and extending to 600 fathoms; soundings up to 80 fathoms being obtained, whilst going at the rate of ten knots an hour—that in point of "accuracy" he had found it "perfect;" and of such "simplicity," "that all his crew soon understood its use." And Captain Ogden, of the U. S. ship *Decatur*, bore the following equally strong testimony to its merits:—

"On our arrival in the neighbourhood of Cape Frio, I laid down the ship's place at 3 o'clock P.M. by chronometer, and found by the chart that we must be on soundings. We were going about seven knots, with studding sails set; therefore I had the instrument passed forward, and requested every man along the side to hold a coil in his hand, until the whole line (150 fathoms) was out. I then saw the lead carefully lowered until it touched the water, and let it run. When we hauled it up we found it had touched bottom in 75 fathoms water, coral and broken shells. We continued to sound with it in the same manner until daylight, when Cape Frio was plain in sight. Commander Ridgely was much pleased with the performance of the lead, but intimated that I had no proof of the depth given being correct. On our arrival off Rio, we were perfectly becalmed. I took the line, accurately marked, and bent it on the patent lead. I then lowered it over the quarter, and let it run until it touched bottom. The line, up and down, showed 31 fathoms. I ordered the lead to be hauled up; and on looking at the glass, the water stood exactly 31. All were then convinced, and declared it to be the most perfect thing of the kind ever invented, which is literally the truth."

We should have thought that after such decisive proofs of the great value of the instrument, it would by this time have come into universal use; but two or three circumstances appear to have hindered this; in the first place, the instrument, though of simple construction, and based on the soundest philosophical principles, required to be delicately, or at least carefully handled, and when tossed by rude hands into the sea, as was but too often the case, instead of being gently lowered down, as it should be, it was apt to get out of order; second, it was not sufficiently protected from being injured by coming in contact with rocky bottoms; and, third, it was brought out at too high a price. Mr. Ogden has made it his study, to obviate these objections, and has now produced an improved edition of the instrument* so unexceptionable in every respect, that it must now, we apprehend, speedily supersede every other contrivance of the sort.

The peculiar value of this instrument consists in its enabling soundings to be taken while a ship is under way, without the necessity of rounding to the wind on every occasion; and in the infallible accuracy (being always properly handled) of its indications. The following is the description of the instrument as improved, given in the enrolled specification.

Fig. 1 of the annexed engravings exhibits an external elevation of a sounding instrument embracing the said improvements in its complete state, but detached from an outer casing, in which it is enclosed, as for the sake of protection, and also of giving additional weight. Fig. 2 is a front longitudinal section of the instrument, as enclosed in its outer casing; and, fig. 3, a transverse section on the line *x y*, or a top view of the instrument, supposing the cap E removed; B and A are two tubes, (which may be of any relative diameter, though in practice, it is preferred that B should be about double that of A); one, A, is of glass, and the other, B, of metal, and both are enclosed in a larger tube of metal, W. The glass tube A, has a separate

* Patented, on behalf of the inventor, in the name of R. A. Brooman, December 19, 1851.

casing F, within which it is eccentrically fixed, by means of a packing of plaster of Paris, so that it may at one side come up against, and be seen through a long slit *s*, left in the side of the tube W, and a corresponding one in the casing F. E E′ are caps which screw on to the tube W at top and bottom. The portions of W exterior to B and F, are filled up with lead, or some other like solid material. A and B communicate with one another at top through a spiral channel *d*, formed by the insertion of two small buttons, *d d*, at the top of B, there being a stop in the channel, which causes the water to make a complete revolution, before it enters into, or is discharged from the tube B, thereby preventing the escape of air when the instrument is in a horizontal position, or even when inverted; but the tubes A and B have no communication with the outside, except through an aperture *b*, at the bottom of B, and occasionally through a passage tapped in the cap E, when the same is opened (by means of the stop-cock C), for the purpose of obtaining access to the interior of the glass tube A. H H is a strong iron case or frame, within which the whole is enclosed, having openings, I I, at the side through which the water may have access to the aperture *b*, in the bottom of the tube B; K is a scale of numbers affixed alongside of the slot S, to indicate the height to which the water ascends in the tube A, and which height becomes the measure of the depth of water outside on the principle to be next explained. The instrument being attached to the end of the (deep) sea line, and lowered overboard, the water enters through the aperture *b*, in the bottom of the tube B, forces up and compresses the air in the intercommunicating tubes, A and B, with a force exactly proportionate to the depth to which the instrument descends. Now, the amount of the atmospheric resistance being a fixed and known quantity, and the weight of a column of sea water being also a fixed and known quantity, it follows that the height of the column of water in the glass tube A, must always be an exact proportion to the depth of water outside. Thus, assuming the pressure of the atmosphere to be in round numbers 15 lbs. per square inch, and that to be equivalent to 32 feet of sea water, then a pressure of one atmosphere would indicate a depth of 5⅓ fathoms; a pressure of two atmospheres, a depth of 10⅔ fathoms; a pressure of three atmospheres, a depth of 16 fathoms, and so on progressively. I therefore first ascertain by experiment the exact pressure required to make the water begin to overflow from B to A, and adopt that point as the commencement of the scale. Suppose it to be 45 lbs. to the square inch, this would give 16 fathoms on the scale; then another atmosphere or 60 lbs., would give 21⅓; and so on progressively. However, it must be observed in practice, that as no two glass tubes are ever found precisely alike in diameter, it is impossible to form beforehand a scale of numbers suitable for all tubes; and such a scale, therefore, can only be arrived at in each and every case by actual experiment. I find it convenient, for this purpose, to gauge a number of these instruments at a time, say, twenty or thirty, enclosing them in a strong cylinder filled with water, the top of which is firmly screwed down, and applying the hydraulic pressure at the bottom. No average result obtained in this way can pretend to literal or theoretical exactness, but it will be found sufficiently near the truth to exclude any serious amount of practical error.

Claim—What I claim is the construction of sounding instruments in such manner, that the pressure of the water into which they are made to descend shall cause an indicator, or register tube enclosed therein, to be filled with water (or other fluid) to a height exactly proportionate to the depth of the descent or sounding; as also the graduated scale *k*, the spiral channel *c*, and the outer casing, H H.

ON IMPOSSIBLE EQUATIONS.

The following solutions were communicated to Mr. Cockle more than a year ago, and are now offered for insertion in the *Mech. Mag.*, at his suggestion. They relate to two equations which were noticed in vol. liv., pp. 28 and 403; the former by Messrs. Cockle and Harley, and the latter by Mr. Septimus Tebay, of Preston; all of whose observations on the subject may be profitably consulted. Mr. Harley has since reconsidered the first equation in his paper

"*On Impossible and other Surd Equations*," recently printed in the "*Memoirs of the Manchester Philosophical Society;*" a discussion equally remarkable for its elegance and originality. The only peculiarity in the following method of solution consists in not permitting the x's to destroy each other in the final equation,—a procedure which may perhaps be found useful in other cases.

I. Solve the equation

$$\sqrt{x}+\sqrt{x+1}=0.$$

Since

$$\sqrt{x}=-\sqrt{x+1}.$$

Consequently

$$x-x=\pm 1 \ldots\ldots\ldots\ldots (1).$$

$$\therefore x=\pm\frac{1}{1-1}=\pm\frac{1}{0}=\pm\infty.$$

This is the same numerical result as is given by Mr. Harley's method, and confirms Mr. Cockle's opinion that Mr. Harley's solution is "an ingenious combination of the ordinary symbols of algebra" (*Mech Mag.*, vol. liv., p. 66.) It is perhaps worthy of notice that both values of x in equation (1) are obtained by *varying the process of transposition.*

II. Solve the equation

$$\sqrt{x+1}+\sqrt{x-1}=0.$$

1. From the given equation we have

$$\sqrt{x+1}=-\sqrt{x-1}.$$

$$\therefore x+1=\iota-1.$$

Whence, as before,

$$=\pm\frac{2}{1-1}=\pm\frac{2}{0}\ \pm\infty\ .$$

2. By Harley's method we have

$$\sqrt{x+1}=n\ \sqrt{x-1}\ldots\ldots (1).$$

Or

$$\sqrt{x-1}=n\ \sqrt{x+1}\ldots\ldots (2).$$

Whence

$$n^2\ (x-1)=x+1\ldots\ldots\ldots (3).$$

Or

$$n^2\ (x+1)=x-1\ldots\ldots\ldots (4).$$

From (3),

$$x=+\left(\frac{n^2+1}{n^2-1}\right)=+\frac{2}{0}=+\infty.$$

From (4),

$$x=-\left(\frac{n^2+1}{n^2-1}\right)=-\frac{2}{0}=-\infty.$$

Hence, as before,

$$x=\pm\frac{2}{0}=\pm\infty.$$

We may verify this result as follows:

$$\sqrt{\left(\frac{n^2+1}{n^2-1}+1\right)}+\sqrt{\left(\frac{n^2+1}{n^2-1}-1\right)}=\sqrt{\left(\frac{2\ (n+1)}{n-1}\right)}=\sqrt{\left(\frac{0}{-2}\right)}=0.$$

If we multiply the equation

$$\sqrt{x+1}+\sqrt{x-1}=0,$$

by its *complete* congener,

$$\sqrt{x+1}-\sqrt{x-1}=0,$$

we obtain

$$x+1=x-1,$$

and the same results follow as in the first solution. When we multiply the given equation by the *partial* congeners,

$$\sqrt{x\pm 1}=0,$$

the results, as Mr. Tebay observes, are

$$x=\pm 1,$$

which are obviously roots of the respective factors introduced by multiplication; just as in the solution of a congeneric surd equation we more frequently determine the roots of the complete congeners introduced into the solution than the roots of the given equation itself, should any exist.

T. T. WILKINSON.

Burnley, May 29th, 1852.

FORGERY OF STAMPS AND BOARD OF INLAND REVENUE.

Sir,—Will you be so kind as to allow me a few words, not altogether, perhaps, foreign to the purpose of your publication.

Some time ago I accidentally discovered a mode by which the raised impressions of receipt stamps may be taken with great facility, and so perfectly as not to be detected from the original. Thinking the matter of some importance, I wrote to Lord John Russell, inclosing specimens of the impressions I had taken from stamps. His Lordship immediately forwarded my communication, with the specimens, to the Board of Inland Revenue. The Board, after some delay, condescended to reply, but in terms so official, starched, and insolent, that one

would have thought that I had committed some high crime, rather than simply to have submitted information which was thought to be useful. The Board almost promised me transportation for my pains. I replied in my turn, and justified myself for what I had done; further, I wrote to the head of the department, Sir Charles Wood, informing him of what had taken place, reminding him that, if the information contained in my communication to Lord John Russell were of no use to the Board, it might be to the country, and that I should take an early opportunity of publishing the *modus operandi*, which, I should have observed before, I offered to show the Board; and at their own Board-table, if they pleased, I offered to take an impression from any stamp they might choose. Sir Charles returned me *no* answer.

Now, Sir, do not suppose that I troubled myself with being angry at what may be called scurvy treatment; if I have any feeling in the matter, it is that of supreme contempt for the little-headed group composing the Board. But enough of this; I ought not to have obtruded myself within the "wind of their nobility;" I ought to have remembered the Board of Admiralty and Admiral Napier, and the Board of Customs and the merchants of the city of London.

Now to my point, Sir. All impression on paper, whether raised or sunk, is open to forgery by one person without the least trouble or risk. I do not mean to say that I alone am in possession of this fact; perhaps not. But I do think the country should know the secret, if it may be so called; besides, in many workshops the process may be useful, and straightforward simplicity take the place of more roundabout contrivances by its publication.

Method.

To take exact impression of stamps, or, in fact, of any device, raised or imprinted, that is, sunk on paper, cut a piece of card-board, say to the breadth of half an inch, with which form a ring just the dimension of the impression to be taken; then pour within the said ring, which surrounds the spot, melted fusible metal: the carding will prevent the metal from running away, and in a few minutes it will cool and take the impression, without the slightest injury to the paper from which it was taken. I need not say that the impression, &c., taken *must be the same as the original.*

Fusible metal, according to Brande, is a compound of eight parts of bismuth, five of lead, and three of tin, which liquefies at 212°, and below that if one part of quicksilver is added.

I am, Sir, yours, &c.,

HY. BROWN.

187, Whitechapel-road.

THE IRISH ELECTRIC TELEGRAPH.—FURTHER PARTICULARS.

(From *Saunders' Journal.*)

* * *

"The Howth and Holyhead Submarine Telegraph is now an established fact, and its promoters are well worthy of the earnest congratulations of all who are capable of appreciating the attributes of decision, energy, and skill. It is to Messrs. Newall and Co., of Gateshead-upon-Tyne, assisted by the Gutta Percha Company, of London, that Europe and America are indebted for the Howth and Holyhead Submarine Electric Telegraph. Three several Companies had been advertised for telegraphing across the Irish Sea; the usual means for alluring shareholders, electing directors, appointing agents, engineers, &c., had all been put into operation. These necessarily ponderous and unwieldy corporations were slowly and laboriously proceeding to put their much-talked-of schemes into practice, when about three weeks ago the idea flashed across the mind of Mr. R. S. Newall—'This Irish Telegraph will be a paying concern; it will not require much capital. The firm with which I am connected have facilities for doing the thing; why should not we set about it and do it at once ourselves.' He accordingly explained his view to his partners, got their consent, and immediately applied to Mr. S. Statham, conductor of the Gutta Percha Works, Wharf-road. 'Can you supply us with eighty miles of telegraph wire, doubly covered with gutta percha, within a fortnight?' 'I'll try,' was Mr. Statham's response; and accordingly it was commenced and finished within the time agreed on, being latterly done at the rate of twelve miles a day. The coated wire was then sent down to Gateshead-upon-Tyne to be surrounded with twelve galvanised iron wires, twisted round it in a spiral. The cable being finished, Mr. Newall called on Mr. Statham last Tuesday week, and then

for the first time told him the object for which it was manufactured. It was agreed that Mr. Statham should bring a staff of assistance, and the requisite apparatus, to Holyhead the next day to meet the wire. The Admiralty was communicated with, and kindly sent down Captain Beechy, R.N., to give his valuable advice and assistance; and they also lent the *Prospero*, Government steamer, Lieutenant Aldridge, R.N., to aid in carrying out the undertaking. Meanwhile the *Britannia* was hired to bring the cable from Whitehaven, and afterwards pay it out from Holyhead to Dublin. The enormous cable, eighty miles in length, weighing a ton per mile, and all in one continuous piece, was wound up into immense coils, placed on trucks, one after the other, and drawn by steam from Newcastle-upon-Tyne to Whitehaven — from one side of England to the other. The *Britannia*, as has been stated, steamed to Whitehaven to take it on board, when, unfortunately, it was found that the entrance to the dock was too narrow to permit the vessel to enter. The coils had then to be replaced on trucks, and carried to Maryport, where they were at length embarked, and speedily conveyed to Holyhead. Now, it might be hoped that all difficulties had been overcome, and that there was nothing to do but to lay down the line; but Mr. Statham, who had already achieved the Dover and Calais connection, knew too well the dangers and accidents to which those concerned were liable in the event of a gale to trust anything to chance, or to proceed one step further without a careful preliminary inspection. The insulation of the copper was tested and found to be defective; then the portions stowed in the various departments of the ship were examined separately, and at last it was ascertained that the fault lay in some eight miles of line lying in the bottom of the hold. There was nothing for it but to disembark the leviathan bulk, and to track it step by step to the exact seat of the defect. This was accordingly done, the fault remedied, and by Tuesday morning the giant rope was in readiness to be placed in its abiding home. Early on Tuesday morning the *Britannia*, under the command of Captain Browne, and towed by the *Prospero*, under Lieutenant Aldridge, R.N., commenced paying out the cable, according as it sunk by its own weight to the bottom of the sea, along the route from Holyhead to Howth. There were on board, besides the officers and crew, Mr. R. S. Newall, with a gang from the Gateshead Works; Mr. Samuel Statham, with a party from the Gutta Percha Works; Mr. Thomas Allan, the inventor of a new telegraph instrument; and Mr. Reid, jun. Mr. L. D. Gordon (Mr. Newall's partner), had previously departed to Dublin to supervise the land line from the latter city to Howth. Occasional difficulties were experienced in the paying out of the coils, but they were all overcome through the skill and energy of Messrs. Statham and Newall. Slowly the vessels ploughed on at a rate varying from three to five miles an hour, and at length, between 7 and 8 o'clock on the same evening, the *Britannia* anchored off Howth. An electric current was sent through the wire to Holyhead, and the returning answer brought the pleasing intelligence that the line was all right throughout, and perfectly insulated. The portion of cable requisite for completing the connection with the shore and land line was now laid down, and the parties engaged in this arduous undertaking sought some repose, after nearly two days and nights of excessive and harrowing exertion, about daybreak on Wednesday morning. It might be supposed that everything was now smooth and prosperous. Buoyant with hope, those who had already suffered so much in the attempt went down at noon on Wednesday to the Amiens-street terminus to test the success of their enterprise. The batteries were put in action, the wires were connected, and they anxiously awaited a reply, but none arrived! They telegraphed to Howth, and were answered: the fault was further off than the land line. An express train was provided, and they dashed down to Howth. Again they telegraphed to Holyhead from the shore—no answer! They took a boat and rowed to the ship. A message sent to Holyhead brought back the reply that all was right there. It was now manifest that the fault lay somewhere between the *Britannia* and the shore. It was necessary again to take up this portion of the line, and test it little by little. The defect was probably caused by the straining of the ship upon a line comparatively short. When discovered, it was soon remedied on board. It was again recoiled into an open boat, the crew of which made a renewed attempt to lay it down to the shore. In the meantime Messrs. Statham and Newall proceeded to shore in another boat with the instruments; but when they overtook the boat which had been engaged in paying out the cable, they found it at a stand, the crew having managed to sink the whole line while still some distance from the shore. Again Mr. Statham had to return to the ship, get another mile of cable uncoiled, recoil it in the boat, and then row to where the deficient extremity of the cable remained; and there, in an open boat, at 2 o'clock in the morning, with the aid of a little burning

spirits, to solder the wires, reunite the gutta percha, and restore the cable to a continuous and insulated whole. This was effected, the remaining distance to the shore laid down, and that night of toil was at length repaid by a success the most ample and complete. On Thursday the *Britannia* let go the cable and steamed away, while those on shore, after repeated experiments, were satisfactorily convinced that the communication with Holyhead was now at length without impediment."

IMPROVED LUCIFER MATCHES.

Messrs. J. and E. Sturge of Birmingham, are now manufacturing on a large scale a new description of phosphorus for lucifer matches (called amorphous phosphorus), which possesses the following advantages over the old. 1. It involves much less risk of destruction of life and property by fire; 2. It is more suitable for matches intended for warm climates; 3. It is not poisonous in the solid form, as that matches made with it will be comparatively harmless if sucked or chewed; and, 4. It does not give off any noxious vapour at ordinary temperature.

The simplest lucifer-match consists of a splinter of wood dipped into melted phosphorus, and then covered with gum or glue. More frequently phosphorus is associated with chlorate or nitrate of potass, and with sulphur or sulphuret of antimony. The employment of such materials necessarily renders the manufacture a very hazardous one, from the risk of fire, and in certain of the Continental states the preparation of lucifer-matches has been absolutely prohibited. Another and quite unexpected hazard was soon found to attend their manufacture. The workpeople were attacked by a very painful and often fatal disease of the jawbones, which became carious, occasioning in many cases death, in several loss of the upper or under jaw, or other severe mutilation, and disfigurement, and always much suffering. The German surgeons, who have paid great attention to this distressing disease, refer it to the absorption of the vapour of phosphorus, given off chiefly during the drying of the matches, but likewise at other stages of the manufacture. Phosphorus, also, is well known to act as a poison when swallowed in the solid form, and as it occurs in this condition in lucifer-matches, fatal accidents have more than once occurred from children sucking them.

The red or amorphous phosphorus is much less combustible than ordinary phosphorus, and not at all poisonous. To prepare the new substance, ordinary phosphorus is melted in a peculiarly constructed retort, and kept for some hours at a temperature of about 500° Fahr. A very singular change is the result of this heating, during which the phosphorus combines with caloric, and renders it latent, but does not otherwise undergo any chemical alteration. The original phosphorus is a pale yellow or white transparent body, so combustible that it must be kept under cold water, and when brought into the air grows luminous even at the freezing point, and enters into full blaze at a temperature of about 150° Fahr. By the prolonged heating it becomes a soft opaque mass, which is easily pulverised, and then forms an uncrystalline powder of a scarlet, crimson, purple-brown, or brown-black colour, so incombustible that it may be exposed in summer in the open air, and handled with impunity; nor does it grow luminous till it is about to enter into full combustion at the temperature of 482° Fahr. It is further so harmless to living creatures, that more than a hundred grains have been given to dogs without doing them any injury. Although, in its free state, it is sparingly combustible, yet, when it is mixed with the ordinary ingredients of lucifer-matches, such as sulphur or sulphuret of antimony and chlorate of potass, it kindles readily.

THE "GREAT BRITAIN" STEAMER.

The *Scientific American* furnishes the following account of the alterations made in this vessel, previous to her late restoration to active service:—

This noble vessel, the largest steamship afloat, arrived at this port on last Friday, at noon. She left Liverpool on the 1st, at 9 A.M., thus making the passage in thirteen days and three hours, having beaten the *Washington*, a paddle-wheel steamer, two days. It is now five years since she visited our shores before, since which time she has occupied public attention, perhaps, more than any other vessel ever built. Her beaching in Dundrum Bay; the skill called out to extricate her from the perilous position in which she was placed, and her long, long inglorious repose in dock, are things with which all are familiar. She is built of iron; no wooden vessel would have undergone what she has. She has been completely refitted and renovated. Her tonnage is 3,500 tons.

She has ten kelsons of 3 feet in depth, running the entire length, strengthened by transverse floors every 3 feet,—the whole being covered by a wrought iron platform. Her frame, for the space occupied by the engine and boilers, and for 10 feet beyond

at each end, is of double angle irons only 18 inches apart. Three double lines of angle iron stringers run under each dock, and the stern and bow are both still further strengthened by a series of deep shelves of wrought iron, while to the latter there are heavy breast-hooks in addition. The decks are supported throughout by strong wrought-iron stanchions, based on the lines of kelsons, and carried thence continuously to the upper deck. The space occupied by the machinery is fastened in the strongest way by seven wrought-iron box beams and six iron-plated beams, secured in each case to a large surface of the ship's frame. The engine bearers are of the height of the platform, weigh many tons, and together with the gearing and trust beams, are of wrought iron, of hitherto unparalleled strength. Five water-tight bulkheads divide the ship: three through her entire height to the main deck—one being placed at either end of the engines and boiler space, so as entirely to inclose them, while two are carried up as high as her lower deck. The coal bunkers are entirely of iron, on each side of the machinery, and on the forward platform. The engines are a beautiful pair of oscillators, by John Penn and Son, of London, with 82-inch cylinders and 6 feet stroke. The principle of the geared engine has been adopted, in order that full advantage might be taken of the comparatively fine pitch of the screw, which has been fixed at 19 feet, its diameter being 15 feet 6 inches. The diameter of the driving wheel is 14 feet, and of the pinion, 4 feet 8 inches; the entire breadth of both being 4 feet; and the jarring, usual in wheel gearing, is prevented by its division into four parts placed slightly in advance of each other. The boilers, six in number, with two funnels, are also made by Messrs. Penn and Son. They are tubular, and are so arranged that they can be used collectively, or separately, as occasion may require. There are eight pumps placed in different parts of the ship, independent of the bilge pumps, in connection with the engine. In addition to the *Great Britain* being of iron, with an iron deck over her boilers and engines, every arrangement has been made to guard against the possibility of fire. There is nothing but iron near the funnels, which have two outside iron castings. The galleys are placed upon iron decks, on stands of the same metal, with a free circulation of air beneath. A pipe from the boiler will enable a jet of steam to be directed, in a moment's notice, to all parts in the immediate neighbourhood. A hose, attached to the fire engine, will reach from one end of the ship to the other, and fire annihilators will be kept ready in different parts. Ten life boats are carried—eight on davits, which will require only one person to lower them; and are so hung as to render it impossible for them to reach the water except on an even keel, while an arrangement will be made enabling the two on deck to be lowered with great ease and rapidity. Second to no other steam ship of her class, the *Great Britain* spreads on her four masts nearly 13,000 yards of canvass, and fairly competes with any sailing vessel in the world.

ON GALVANIC PLATING.—BY MM. E. THOMAS AND V. DELISSE.

The researches of De Ruolz and Mr. Elkington have proved that all solutions of the salts of silver will not give, with the aid of the battery, constant and adherent deposits of metallic silver; that this property is limited to certain particular solutions, the characters of which may be thus defined:—1st., the liquor must be a sufficiently good conductor of electricity; 2nd., under the influence of the electric current it must be able to deposit only silver; 3rd., the liquor must not attack the metal intended to be covered; 4th., the liquor must have an alkaline reaction. To these four conditions M. Bouilhet has lately added a fifth, which is, according to him, indisputable; it is that the liquor must contain a double salt of silver and a fixed alkali which, by decomposing, give rise to the plating.

Only two series of solutions agree with all these conditions: 1st., the solutions of silver in the alkaline cyanides which alone have hitherto furnished constant and satisfactory results on all these points; 2nd., solutions of silver in the alkaline hyposulphite of soda or of potassa, which give good indications of plating, but which are subject to such variations in the thickness and adherence of the silver deposited, that, notwithstanding their lower price these hyposulphites cannot be substituted for the alkaline cyanides.

The salts with ammoniacal bases, of which several dissolve oxide of silver easily and in great quantity, will not, according to Mr. Elkington, give solutions capable of plating. Nevertheless it is into this series of compounds that we have made our investigation.

In the first place we convinced ourselves that no salt of ammonia, whether neutral or alkaline, holding oxide of silver in solution in water, will deposit metallic silver in a constant and adherent layer; the ammonia coming to the negative destroys the deposition which is beginning to form, and attacks the metal which it is intended to cover.

We had a commencement of success by employing alcohol as a vehicle, by saturating it with nitrate of ammonia to render the

bath a conductor, then dissolving in it the double nitrate of silver and ammonia in as neutral a state as possible. But, although this bath gave a thick and adherent plating, it was subject to too many casual obstacles. The too great alkalinity of the liquor, the lowering of the temperature, the presence of the least trace of chloride, will prevent a good result; moreover, the amount of electricity used must be considerable: and the copper intended to receive the deposit of silver requires to be first covered by a particle of the metal to be used in the operation of washing.

We were then led to remark that the plating depended essentially on the reductive power of the bath, and a great number of experiments made us see that although alkalinity might be a necessary character, it was an absolute obstacle when using ammoniacal salts; that the acidity of the bath, so far from being injurious, was indispensable under those circumstances, provided that it was due to an acid greedy of oxygen, and which did not attack copper too powerfully.

We must here mention that we did not endeavour to determine the mode of action of the alkaline cyanides in plating, but merely the conditions in which it would be possible to deposit metallic silver on copper by employing solutions of the salts of ammonia.

A sealed packet, deposited by us at the sitting of the 23rd of February, contains a series of experiments made on this subject; but without asking as yet for the opening of it because it contains the beginning of some other investigations which we have not yet finished, we will briefly retrace here our principal experiments.

I. Whatever may be the solution of silver in a salt of ammonia on which we operate, it will only give a constant and adherent deposit of silver when it contains a free acid, greedy of oxygen, such as phosphorous, sulphurus, hypophosphorous and hyposulphurus acids. Thus the neutral or alkaline hyposulphite of ammonia does not furnish good plating; it will give it, however, as soon as it is rendered distinctly acid with an acid greedy of oxygen.

II. All the acids greedy of oxygen do not succeed; this is the case with nitrous acid, because, probably, it has too much affinity for the metal intended to be covered.

III. All the solutions of salts of ammonia capable of dissolving oxide of silver will not succeed; moreover it is necessary that the solution of silver should be staple; thus sulphate of ammonia plates at first, but it soon decomposes rapidly under the action of the pile, and almost the whole of the silver is precipitated. But, if hyposulphate of ammonia be added to the acid sulphate of ammonia, it renders it capable of furnishing a more stable bath of silver, giving the best results.

IV. The presence of a double salt of ammonia and silver is not a sufficient condition for the bath: in fact, the neutral solution of double nitrate of ammonia and silver will not plate; it gives marks of successful plating if saturated with sulphurous acid. It is the same with the double sulphate, with the exception of the stability of the bath, and à *fortiori*, it is the same with the double hyposulphate.

V. The presence of a double salt of silver and any alkali whatever is not a condition necessary for bath plating. In fact, the citrate of silver, as mentioned by M. Regnault, prepared by passing hydrogen over citrate of silver—precipitated without heat to avoid the formation of aconitic acid—gives a solution which plates very well, but which decomposes in the light, which renders it impossible to employ it. Nitrate of silver also plates well at first, but the affinity of nitrous acid for copper soon impedes it.

VI. It appears to us that in the baths we have tried the salt of ammonia has no other object than to keep the silver in a state of solution whilst the power of plating is due entirely to the presence of a free acid greedy of oxygen. This acid really has no other effect than that of retaining the ammonia without attacking the copper; for, if we acidify the bath with sulphuric acid, it gives no plating. Nevertheless, we may ascertain, by agitating copper turnings quite free from verdigris with sulphuric acid, that this metal is not sensibly attacked, whereas, sulphuric acid, in the same conditions, attacks it powerfully.

VII. In the baths which we have tried a platinum anode gives better results than a silver anode. Indeed, the anode of silver, whether in these baths or in those of cyanide, does not dissolve in proportion to the silver deposited on the cathode; it attacks besides a notable proportion of silver from the anode which is precipitated in the state of subsalt. Only in the baths of cyanide, the soluble anode must be used, to avoid the disengagement of hydrocyanic acid, whereas, the disengagement of sulphurous or hyposulphurus acid causes no inconvenience.

VIII. The cleaning of the pieces intended for plating should vary according to the reaction of the bath, to obtain adherence: cleaning with acids will cause adherence only in acid baths; it destroys, on the contrary, the adherence in alkaline baths. This may perhaps result from the different molecular state of the copper when cleaned with pummice and potassa from when cleaned in an acid bath.

To sum up, the bath which gave us the best results is a mixture at 8 degrees of acid bisulphate and hyposulphite of ammonia, in which was dissolved oxide of silver or an insoluble salt of this base, chloride for example. Several eminent men, MM. Dumas, Payen, Peligot, E. Becquerel, have already done us the honour of witnessing the experiments, and have appeared to admit their accuracy.

This bath, which appears subject to quite different conditions to those hitherto required, has, moreover, an advantage over the cyanide baths which is worthy of notice, insomuch as it is quite inoffensive to the health of those who employ it, a consideration which may perhaps have some value in the eyes of the Academy. Besides, this bath is practically economical, for the salts which compose it are of small value, and, moreover, it is a good conductor of electricity, it requires less of it than in alkaline baths.—*Chemist, translated from Comptes Rendus*, No. 15, April 12, 1852.

TUKE'S REGISTERED WATER CLOSET.

(John Tuke, of Doncaster, in the county of York, Plumber. Proprietor.)

Fig. 1. Fig. 2.

Description.

Fig. 1 of the above engravings is a plan, and fig. 2 a section of this water closet. A is the basin; B, a supplementary cistern, or reservoir; C, the supply pipe, and D, a ball cock; E, the water scatterer; F, an opening in the basin to allow a supply of water to flow through it, into the cistern B; G is a pipe for connecting the basin A, with the soil-pipe H; I is a valve, fitting close upon the valve seat, K; L, a rod passing from the valve through a stuffing-box, in the cover of the soil pipe to the outside of the seat, it terminates in a handle, to allow of the valve being lifted when required; M is a pipe for carrying off the waste water.

The effect of these arrangements is that the basin is always kept partially filled with water, and is thereby sealed, so that no unpleasant exhalations can arise.

HODGSON'S PARABOLIC PROPELLER.

We have repeatedly pointed out to notice the superior advantages offered by this description of screw propeller (see *ante*, vol. xli., pp. 238, 256, 268,—xlii 234—xlv., 550—xlix, 130), and we have once more our attention forcibly called to it by a paper of testimonials in its favour of more than ordinary weight and authority. First, there is a Report by Dr. Woolley, the learned Principal of the School of Mathematics and Naval Construction, at Portsmouth, in which he demonstrates, with singular ability and clearness, the mathematical properties by which the parabolic propeller is distinguished from and superior to the screws of Lowe and others. Another Report from Alexander Gordon, Esq., C.E., takes a similar view of the essential difference between the parabolic propeller and the ordinary screws, and enforces it by some practical considerations which must carry the most perfect conviction along with them. We subjoin the more material parts of both reports:

From Dr. Woolley's Report.

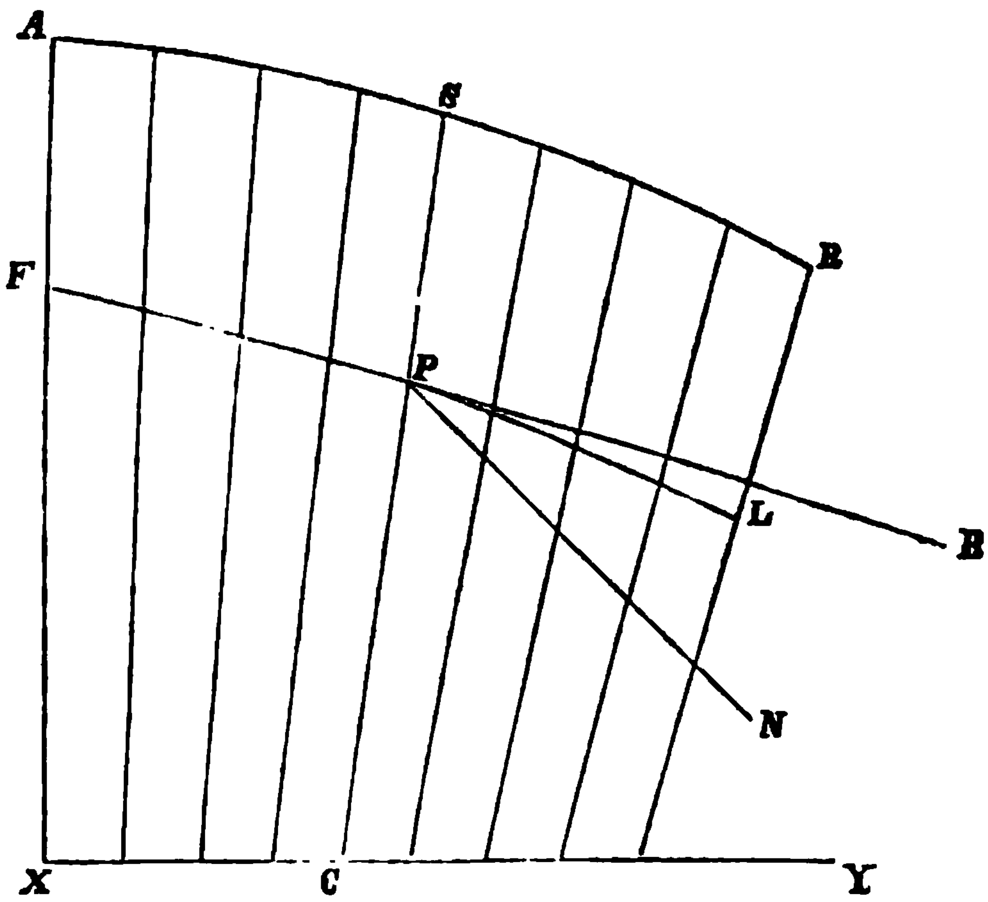
The invention of Lowe (which is the earlier in point of date) consists in attaching to a revolving shaft, below the water-line of the vessel, and running from stem to stern of the vessel, one or more curved blades, "*each a portion of a curve, which, if continued, would produce a screw.*" And Lowe states the merit of his invention to be, that "There being only sections or portions of a screw employed, each blade is a propelling instrument, which allows the water to pass away in all directions, except at that point where the instrument is in full action; whence there is no choking or holding the water towards the centre of motion, which is the case in all complete screws." The object of Lowe's invention was obviously, therefore, not to improve upon the *form* of the propelling surface, but to remedy the evils which had been previously experienced from the use of a complete screw; and this Lowe proposed to effect by limiting the surface to a PORTION only of a complete convolution. The surface he used was a portion of a screw; and all screws are among the surfaces known among geometricians by the name of right conoids, which are generated by the motion of a straight line, which is subjected to the three conditions;—1st, of moving always parallel to a fixed plane; 2nd, Of always meeting a straight line at right angles, or in technical language, square to the said plane; and 3rd, Of always meeting the periphery of a curve fixed in magnitude and position, called the "directing curve." The common screw surface, which Lowe employed, is generated by a straight line moving parallel to the base of a right cylinder, and meeting always the axis of such cylinder and the periphery of a helix, traced on the convex surface of the cylinder. Such a surface impinging on water at rest would drive its particles off in directions which are always perpendicular or square to the tangent plane, at each point where the impact takes place, and therefore square to the generating line which passes through each point, which must always lie in the tangent plane; or if it impinge on the water obliquely, each particle of water would be driven off in a direction making the same angle with the normal line square to the tangent plane as the direction of impact made; and lying in one plane with the normal and direction of impact: and hence such water would be *dispersed* and scattered in all directions from the surface of the screw.

Now the invention of Mr. Hodgson consists in two particulars; 1st, In affixing the screw-blades or propeller-blades to the revolving shaft or axis in a direction not square or perpendicular thereto, as is the case with the surface used by James Lowe, but oblique thereto in such manner as to take greater hold of the water; and 2nd, In adopting what he calls a "parabolic propeller," which may be conceived as generated by a parabola of varying form, whose vertices are arranged in the revolving shaft or axis, and whose concavities are turned *obliquely* to the axis from the stem towards the stern of the ship, and always passing through the perimeter of a directing curve. Such a surface COULD NOT be generated by the motion of a straight line at all, nor could any straight line be found which would coincide with or lie along such surface in all its points. A right conoid or screw can always be easily worked into a female screw or nut formed on the same lines; but were a female surface or nut made on the same lines as the parabolic propeller, the parabolic propeller could not possibly be worked into it,—which shows clearly that the two surfaces are entirely distinct. Moreover, the parabolic propeller impinging on water at rest drives it in the direction of the normal at each point of impact; and such normal is perpendicular or square to the line which touches the parabolic section at such point, which is bent *towards* the axis or revolving shaft. Therefore the particles of water, instead of being scattered or dispersed, would be collected towards the foci of the parabolas; and if the propeller impinged *obliquely* on the water, for a similar reason the particles would be driven in directions still more nearly converging to the foci; and therefore the water, not being allowed to escape freely, would be collected, offering a greater body for the propeller to act upon, and thereby increasing its effect. The difference between the two instruments may be still further illustrated by the following diagrams:

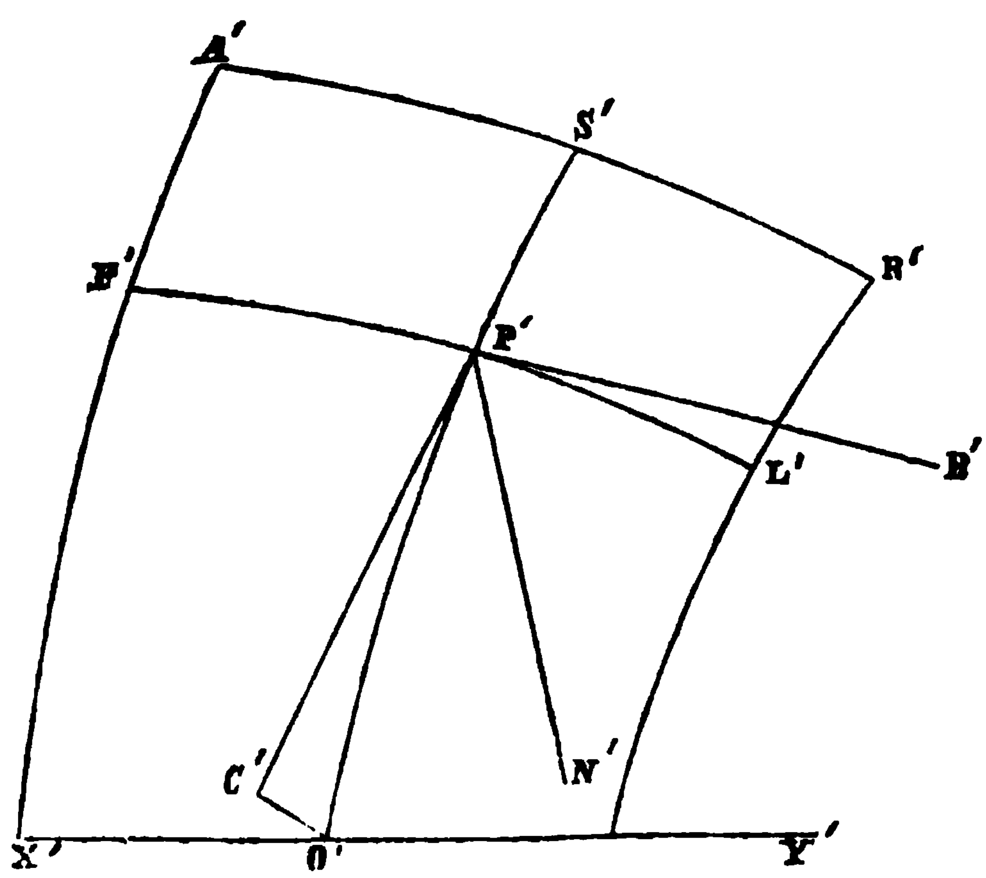
In the following figures, XY is the axis of Lowe's screw; CPS a generating line perpendicular to XY; FPL a section of the surface through P, made by a concentric cylinder; PB the tangent to this section at P; CPB is the tangent plane, and PN, perpendicular to it, the normal, and therefore not inclined downwards to the axis.

X′Y′ is the axis of Hodgson's Parabolic Propeller; O′P′S′ the parabolic section through P′; F′P′L′ a section made by a cylinder, whose axis is X′Y′; P′C′ a tangent to parabola O′P′S′, and falling not on the axis, but considerably to one side, as at C′, and inclined to X′Y′, at an acute angle; P′B′ a tangent to the section F′P′L′. Then C′P′B′ is the tangent plane, and P′N′ the normal, inclined downwards towards the axis, making an angle with the horizontal plane through it, which added to the angle

Lowe's Screw Propeller.



Hodgson's Parabolic Propeller.



P'C'O', will make a right angle; whereas in Lowe's propeller PN is parallel to the horizontal plane in which XY is..

The invention of Lowe, in short, refers to screw surfaces of the common form, and has for its object to scatter and disperse the water, except at the point where the screw is in full action; while that of Hodgson introduces a propeller of a different form, and has for its object to make the water *converge*, so as to allow the propeller to *take a firmer hold.*

From Report of Alexander Gordon, Esq., C.E.

Mr. Lowe declares that he does not claim the application of curved blades generally, but describes, in his specification, his propeller as consisting of a shaft or axis, to which are attached "one or more curved blades, being portions of a screw, which, if continued, would form a screw;" and in my opinion this does truly describe the construction of a screw.

Mr. Hodgson's propeller is not a screw it is a parabolic instrument. The lines from the centre of the propeller-shaft to the periphery, or outside of the propeller-blades, are a series of parabolic curves, projected so as to have their foci at any distance from the propeller suitable for the propulsion of the vessel. This parabolic

propeller consists of a shaft, to which two or more parabolic blades are attached. They are no portions of a screw, and if they were continued could never be made to produce a screw.

Mr. Lowe's propeller has the action of a screw. When driven into any plastic body, it can be withdrawn without tearing out the threads of the female screw. When driven into or through water, the motion which it communicates to the water is *centrifugal* or *diverging*.

Mr. Hodgson's parabolic propeller, when driven into a plastic body, will bore the hole out. It leaves no female screw, but leaves a hollow paraboloidal cavity. When driven into or through water, the motion resulting is *centripetal*, or in lines *converging* to the foci.

These reports are backed up by numerous letters from ship-captains and others, who have had personal experience of the working of the parabolic propeller. The following is from the captain of the *Corkscrew* steamer:

I have now had more experience of this mode of propulsion than probably any other merchant-captain trading from the port of London, and am well able to speak to the comparative merits of the different forms of propellers which have been adopted.

"The great defect of Lowe's form, used in the *Corkscrew*, was the excessive vibration attending it, which caused such a disturbance of the compasses, that no reliance could be placed in their indications. I have frequently experienced in the English Channel a deviation of three or four points from this cause, which, I need not say, is a very serious consideration in foggy or hazy weather. Pilots have repeatedly refused, on this account, to be answerable for the safe pilotage of my vessel through such difficult passages as the Swin and Prince's Channel. With the Parabolic Propeller, on the contrary, of which I have had now upwards of two years' experience, the vibration is so small as not to affect the compasses in the least, and to be at midships wholly imperceptible.

"The average speed of the *Corkscrew*, which is a vessel of 160 tons, and fitted with a pair of steam engines of 14 horses' power, and a propeller of 7 feet diameter, is 6½ knots per hour. With the old propeller, on Lowe's plan, I rarely exceeded 5½ knots, the engines working at their average speed; which shows that the slip of the Parabolic Propeller must be very little, as compared with that of the screw. Nor is the efficiency of the Parabolic Propeller less in backing than going ahead. When leaving Hamburgh, at the beginning of the winter of 1849, we had to force our way through the ice; and this we did by repeatedly backing the propeller, and then advancing with full steam power against the icy barrier, which we broke through at last without any injury either to the vessel or to the propeller."

SERIOUS FIRE IN A SLAVE SHIP.—WATER v. THE FIRE ANNIHILATOR.

Sir,—An advertisement in the *Times* contains a fulsome account of the narrow escape from destruction by fire of the *Cossipore* East Indiaman, on her voyage from Calcutta to Demerara, with three hundred *coolies*. The narrative purports to be the copy of a letter, addressed to the Fire Annihilator Company, by the commander of the vessel, Lieut. A. D. Dundas, R.N., who writes as follows:

"On the 26th of December last, towards evening we were alarmed by that thrilling cry of 'Ship's on fire!' On looking forward, the whole fore-part of the ship appeared to be in flames seeming to proceed from the fore hold: fortunately this was not the case, the fire was all on deck, and confined to the house enclosing the long boat; in the latter were stowed pitch, tar, and other combustible stores, which it was dangerous to keep below, and by some unaccountable means they had ignited. When I first saw the flames they were well up to the mainstays, and really appeared so alarming as to induce me at once to order the powder to be thrown overboard, in case it might be forgotten at the last. The crew behaved well, and plying the water vigorously, kept the fire in check; but still I feared that it was insidiously gaining ground, for there were so many inaccessible nooks and corners in the neighbourhood, that water could not be altogether used to advantage. It instantly occurred to me to try the Fire Annihilator, so, pointing the nozzle down the hatchway in the cover of the boat, I stayed the water for a few minutes, and sprang the mine; the effect was instantaneous. One of the crew who was in a good position for observing it, described the vapour as literally licking up the flames as it poured round the interior of the house; all damage was now over, and my chief officer was enabled to enter the boat, and directing the supply of water, we soon extinguished the remaining embers. I may add, that there were six sheep in the boat, and that, although partially singed by the fire, they were not materially injured."

It is somewhat remarkable, and truly unfortunate, that whatever intrinsic

merit may belong to the invention, which it is the object of this advertisement to glorify, all the "*real cases of fire*," at which the *annihilator* figures, are, without a single exception, the most precious pieces of humbug imaginable. The present forms no exception to the rule, and is worth a moment's careful consideration. The commander of the *Cossipore*, no doubt a most worthy man, is evidently most unfortunately prone to be misled by fear, and to be deceived by *appearances*. Thus, he tell us, "The whole fore part of the ship *appeared* to be in flames;" but it was not so. Again; the flames "*appeared* so alarming," that the powder was sent "all among the little fishes!" A needless and unappreciated sacrifice. As the whole of the fire was upon deck, many persons will naturally ask, "Why was not the burning mass at once thrown overboard?" It is true the commander would, in that case, have lost his mutton, but he would most assuredly have saved his bacon—and his powder.

It is at first stated that the fire was confined to the *house*, inclosing the long-boat; but it is afterwards shown to have been confined to *the boat itself*, "in which were stowed pitch, tar, (live sheep), and other combustible stores, which it was dangerous to keep below." The commander seems to have been afflicted with a somewhat treacherous memory, and to have been painfully cognizant of that defect, wherefore he ordered the powder to be thrown overboard at first, that it might not be *forgotten* at last. One of Phillips's fire-annihilators was on board, but was *forgotten* at first, and the crew plied the *water* so vigorously that "the fire was kept in check," and would, no doubt, soon have been extinguished by that means; but, after a while, "it instantly occurred" to the commander (who still feared) to try the fire-annihilator, and in order to have a chance of trying this highly interesting experiment, upon the result of which hung the lives of nearly 350 human beings, *the water was stayed!* The annihilator was discharged. The effect is described as instantaneous. The vapour is said to have licked up the flame as it poured round the *interior of the house*, enabling the chief officer to *enter the boat*, and so direct the supply of *water* as to extinguish the *remaining fire*, thus completing what it had so successfully begun. The work was neither *begun* nor *finished* by the annihilator, whose auxiliary aid could have been but of little, if any importance, and only had a chance of being so at all *by staying the successful operation of the water*,—a foolhardy experiment, tried under most reprehensible circumstances, and at the peril of the ship and its numerous occupants.

The *real extent* of this "serious fire," however, may be pretty accurately inferred from the fact, as stated by the commander, that the six sheep stowed in the long boat (with pitch, tar, and other dangerous combustibles), which was the seat of the fire, were only "partially singed," and "not materially injured!" The flames seem to have been of a most feeling and humane description, and evidently betook themselves "well up to the mainstays," to get out of the way, and to avoid injuring their fleecy neighbours. As a "fire at sea," the foregoing is most provokingly suggestive of "a storm in a wash-hand basin;" and the whole story looks like a "tough yarn" spun by Jack for the especial entertainment of that credulous branch of the service—the marines! In forwarding the foregoing letter, some wag has perpetrated (as I suspect) a "cruel hoax" upon the Annihilator Company, and attempted to practise a very reprehensible imposition upon the maritime world.

I am, Sir, yours sceptically,

AN OLD FIREMAN.

THE EXCISEMAN'S STAFF QUESTION.

Sir,—Feeling no inclination to enter into a controversy upon the "Exciseman's Staff Question," and as I am satisfied my views of that interesting mechanical problem are correct, I shall not trouble you with any further remarks upon it.

Mr. Tebay will not, I am sure, take it amiss when I recommend to him a serious reconsideration of the statements he has hazarded in col. 2, page 444;—'twill pay.

I am, Sir, yours, &c.,

T. S.

June 7, 1852.

RIFLE EXPERIMENTS BY CAPTAIN NORTON.

In the *United Service Journal* for this month it is stated (under the head of "Iron War Steamers," quoting from Sir Howard Douglas's book), that an oak plank three inches thick is proof against a musket-ball fired with four and a half drachms of powder at forty yards. The military musket is three sizes larger in the bore than the military rifle. Captain Norton's expanding shot, fired from the military two-grooved rifle, will pierce through an oak plank four and a half inches thick, at the distance of forty yards. This fact was proved on Thursday last, at Mr. Truelock's shooting gallery, Dawson-street, using a charge of sporting powder of two and a half drachms. This is a great superiority of penetrating power in favour of the rifle, arising from there being no loss of powder by windage, and the greater momentum of the elongated shot striking point foremost like an arrow. A solid shot of the same form will not carry point foremost during its flight, its base (being the heavier end) will struggle to lead, and this contention will derange the accuracy of its flight. In action, the rifle has its duties to perform, but it is the close volley of the musket, instantly followed by the cheer and the charge, that routs the column, spoils the well-concerted plans of a Soult, and wins the victory. See the last charge by the British infantry at Albuera, so admirably described by the historian of the Peninsular war, in which charge the writer of this paragraph acted a part at the head of the grenadiers of the gallant 34th.—*The Warder*.

NEW VOLTAIC BATTERY.

On the 24th ult., a party of scientific gentlemen were invited by Mr. Martyn Roberts to witness a voltaic battery of new construction, and professedly of great economy, which he has at present in action in the neighbourhood of Great Portland-street. The battery consisted of fifty plates of tin, about 6 inches by 4,—each plate being adjusted between two plates of platinum of the same size. These were placed in stoneware cells about two feet deep, which were filled with diluted nitric acid. The object of these deep cells was, to obtain a marketable product which should be sufficiently valuable to cover the cost of the agents employed to effect the development of electricity. The upper stratum of nitric acid acts on the tin, and forms with that metal an oxide, which falls off from the plate the moment it is formed, and is precipitated as an hydrated oxide of tin to the bottom of the cell. This oxide is combined with soda; and as stannate of soda is extensively employed in dyeing and calico-printing; it is stated that this product will yield a profit of 20 per cent. on the cost of the battery by which it is produced;—but this is a point which we are not at present in a position to determine. The electrical action of the fifty pairs of plates was considerable. The current was employed to exhibit the electrical light, and the effects produced were certainly very brilliant. It was not possible to compare it with the result obtained from a Grove's battery, but we judge their powers to be nearly equal. An experiment made on the decomposition of water gave about 7* cubic inches of the mixed gases, oxygen and hydrogen, per minute. We cannot but regard this very ingenious arrangement as an improvement on the ordinary batteries, as far as economy is concerned, where an electric current is required, since the stannate formed must always be of considerable commercial value. It is curious, too, that the stratum of fluid in the immediate neighbourhood of the voltaic plates is kept uniformly of the same specific gravity, notwithstanding that the acid is rapidly removed. The oxide of tin formed takes down water with it, and at the same time establishes a current by which fresh acid is supplied to the plates. We were informed that the battery continued in most uniform action for sixteen hours.—*Athenæum*.

COURT OF QUEEN'S BENCH.—*June*, 1852.

THE QUEEN *v.* LAMING AND EVANS.

Effect of Deposit Specifications.

The defendants, on the 23rd April, 1850, obtained a patent for improvements in the manufacture of gas, &c. The deposit paper upon which the patent was obtained described the invention as consisting of seventeen parts, but the patentees only specified eight of these parts, omitting the others; and they included ten other things not mentioned in the deposit paper, but which, in the specification, they claimed as parts of their invention.

A *scire facias* was recently brought to repeal the patent, on the ground that the patentees had in their specification made these ten claims in fraud of the Crown, and the defendants, on the 3rd of June instant, applied to Sir Frederick Thesiger, the present Attorney-general, for leave to disclaim the several things which they had wrongfully claimed.

The application was opposed on the ground of the fraud committed upon the Crown and its officer; and the Attorney-general refused to permit the defendants to disclaim.

In consequence of this refusal the defend-

* Should be 37.—Ed. M. M.

ants had no defence to the *scire facias*, and on the 8th instant judgment was given in Chancery to repeal and cancel the patent.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JUNE 9, 1852.

WILLIAM EXALL, of Reading, Berks, engineer. *For improvements in certain agricultural implements, and in steam-engines and boilers for driving the same*, Patent dated December 1, 1851.

Claims.—1. The employment of two endless chains, webs, or other suitable flexible surfaces to convey straw or other material to the knives or cutters of chaff cutting machines. [These chains are set at an angle so as to compress the materials at the same time that they carry them under the action of the knives.]

2. The giving to the bearings and journals of the spindle of the cutters or knives of chaff-cutting machines a tapering form [to admit of the spindle being brought into close contact with the bearings when they become worn, and thus insure steadiness in the action of the knives.]

3. The employment of an endless web to convey the straw to the hopper of threshing machines.

4. The reaping or cutting grass or corn by a continuous movement, either by means of a series of cutters carried by an endless revolving chain or band, or by a series of circular cutters, each revolving on a separate spindle or axle.

5. The employment of two endless revolving carrying webs or cloths moving at, or nearly at, right angles to each other, one of which receives the material as it is cut, and conveys it to the other, which latter delivers it at the side of the machine.

6. The construction of a collector or rake in which the axle-tree is made to constitute the general frame or support of all the parts. Also, causing a scraper to move simultaneously with, and in opposition to the tines, in order to accomplish the more speedy and effectual removal of the material from the tines. [This collector or rake is intended to be attached to the reaping machine, which constitutes the subject matter of the two preceding claims, but may also be used detached therefrom.]

7. Inclosing the body of the boiler of portable agricultural steam-engines in a casing, which serves as a return flue for the passage of the heated air and gases to the smoke box and chimney. Also, placing the cylinder in a smoke box on the upper part of the boiler.

8. A mode of relieving a portion of the slide valve from the pressure of the steam.

9. An improved construction of governor or regulator for regulating the speed of the engine.

10. An arrangement for condensing part of the exit steam [by causing it to pass through a pipe to the feed-water, in which it is condensed, and the temperature of which it thereby correspondingly raises.]

11. The employment of two trunk engines set at an angle to each other (preferably an angle of 90°) and both working on one and the same crank on the driving shaft of the engine.

12. Mounting the boiler of moveable agricultural engines on two wheels.

13. An arrangement of parts constituting a steam engine for agricultural purposes. [The whole of the engine is here inclosed in a circular casing which insures great compactness.]

THOMAS BURSTALL, of Lee-crescent, Edgbaston, civil engineer. *For certain improved machinery for manufacturing bricks and other articles from clay alone or mixed with other materials.* Patent dated December 1, 1851.

The patentee describes two arrangements of machinery for manufacturing bricks from moist clay, alone or mixed with other materials, in both of which the distinguishing feature is that steam power is applied directly for giving compression to the materials in the moulds. The claims are for,

1. The application of the direct action of steam pressure for compressing clay alone or mixed with other materials, into bricks, tiles, and other articles.

2. The direct action of steam in combination with the mechanical movement called a "toggle-joint."

3. The direct action of steam in combination with a lever or levers, as may be suitable to produce the required effect.

JOHN MACINTOSH, of Berner's-street, civil engineer. *For improvements in steam engines, in rigging, and propelling vessels, and facilitating their progress through water.* Patent dated December 4, 1851.

1. The patentee describes, an improved construction of rotary engine. The engine consists of a cylinder, within which is placed eccentrically a drum furnished with two sliding plates which act as pistons. So far it resembles others of the class, but it differs from them in having the end plates attached to and revolving with the internal drum. A packing is interposed between the end plates and the sides of the external drum, to make steam-tight the point where they come in contact. The sliding pistons in the internal drum are connected together by rods, so as to move simultaneously, and their packings are acted on by springs attached to the rods, so as to keep them constantly pressed out

against the internal periphery of the external cylinder.

2. The patentee proposes to construct the masts of vessels with a joint at the heel, so that they may be inclined sideways at any required angle to the keel, and thus render the sails on them lifting as well as propelling sails. He also proposes to provide a yard for the foresail and jib-shaped sails to enable the sail to be brought to the wind without inclining the mast. The block for the haulyards is for this purpose furnished with a ring, which slides on a guide attached to the yard.

3. For facilitating the progress of vessels through water, the patentee proposes to cover them with a composition produced by decomposing India rubber in sweet oil by the aid of heat. For marine purposes castor oil and arsenic, or other poisonous materials are added to the composition to prevent the adherence to the ship of barnacles, &c. The compositions thus made do not become dry, but always continue glutinous as at the time of being applied. Gutta percha may be also added if desired. The composition is to be applied in a warm state.

Claims.—1. The improvements in steam engines described.

2. The improvements in rigging vessels.

3. The compositions described, and the application of the same to ships' bottoms.

WILLIAM GRAYSON, of Henley-on-Thames, watch and clock-maker. *For an odometer or road measurer to be attached to carriages for showing distances over which the wheels pass.* Patent dated Dec. 1, 1851.

This apparatus consists of a train or system of wheel-work enclosed in a box attached to one side of the carriage or cab above the axle of the wheels. It is provided with two dials, one outside for the use of the passenger and driver, the other inside for the protection of the proprietor and accessible only to him. The index hands of the two dials are connected together by intermediate gearing, so as to act in unison; but the passenger's index hand is attached to a hollow shaft, fitting over its driving spindle, and actuated by contact, to admit of the hand being set to zero on the entrance of a passenger into the carriage, without deranging the apparatus. The apparatus is set in motion when the wheels of the carriage are revolving, by the intervention of a pendent lever, one end of which is acted on by a pin attached to the nave of one of the wheels, while the other end engages into a ratchet-wheel, forming part of the train of wheelwork, which it moves forward one tooth for every revolution of the wheels. The number of teeth on the ratchet-wheel will be determined by the size of the driving wheels of the carriage, and apparatus may be adapted for use with driving-wheels of different diameters by simply changing the ratchet-wheel.

Claims.—1. The means described of actuating the counting apparatus and the arrangement of wheelwork, constituting the counting apparatus, in which by simply changing the ratchet-wheel the apparatus may be adapted to running wheels of any circumference without further alteration of the wheelwork.

2. The employment and adaptation of two dials and indexes to the indicating apparatus, both indexes being worked by the same train of wheelwork; and one dial and index being employed to serve for the passenger and driver and the other for the proprietor.

WILLIAM WOOD, of Oxford-street, carpet manufacturer. *For improvements in the manufacture and ornamenting of carpets, rugs, and other fabrics.* Patent dated December 4, 1851.

Claims—1. The use of silk waste alone or in combination with other fibrous materials in the manufacture of terry-looped or cut-pile carpets and rugs, and for the warps of other carpets.

2. The printing or dyeing patterns into or on warps or warp materials, by forming cells or compartments for colouring matter of the shape of the pattern required (elongated when intended for cut-pile fabrics), into or in contact with which the warps are pressed.

3. The fixing and retaining on printed warps of any suitable fasteners or fastening arrangements to secure a better defined outline in the pattern.

4. Combining the use of the Jacquard apparatus or draw-loom with printed warps.

5. The freeing of printed carpets, rugs, and other fabrics from the thickening used with the colouring matters by beating or brushing the same when dry, or by other equivalent mechanical means, instead of or in addition to washing it out.

6. The giving additional substance to carpets, hearth-rugs, and mats, by weaving more than four shoots of weft for every wire or terry.

7. The construction of the "trevat," or knife, used for cutting out the wires, when actuated by mechanical means in a mechanical or power-loom, with joints and springs so as to be guided in its traverse across the work by the wire in the fabric.

JAMES THOMPSON and FREDERICK ALTREE, of Compton street, Brunswick-square, bakers. *For certain improvements in the means of and apparatus for heating ovens.* Patent dated December 5, 1851.

These improvements consist in the use, for heating ovens, of ordinary coal gas which

is conveyed by a pipe to the back of the interior of the oven and there ignited. A supply of atmospheric air is introduced by passing the gas pipe through another pipe, one end of which is left open to the air, which passes through to the burner. The gas-pipe is connected with the main by a union joint to admit of its being withdrawn from the ovens when the latter is sufficiently heated. When gas cannot be conveniently obtained, naphtha or other combustible fluid may be used in its place, suitable burners being employed and means used to introduce air to support combustion.

Claim.—The heating of ovens from the caloric evolved by the combustion of gases.

RICHARD ARCHIBALD BROOMAN, of the firm of J. C. Robertson and Co., of 166, Fleet-street, patent-agents. *For certain improved modes of applying electro-chemical action to manufacturing purposes.* (A communication.) Patent dated Dec. 8, 1851.

The nature of this invention consists in the application of chemical, electro-chemical, thermal, and galvanic forces, separately or combined, and under circumstances already to some extent understood and recognised, as well as under certain new and peculiar conditions.

The improvements are applicable to the manufacture and preparation of organic and inorganic substances belonging to the animal, vegetable, and mineral kingdoms, and to the manufactured products thereof, and consist in subjecting them to an electric or galvanic current, which may be produced by chemical combination or decomposition, by sudden or gradual changes of temperature, by galvanic or electrical apparatus, or by a combination of any of these agencies.

"I make use of a battery or pile, which I construct in a peculiar and novel manner. The usual apparatus now in use consists for the most part of plates or portions of two different metals, arranged in pairs so that at each end of the series two different metals are found. Thus a battery or pile of six cells, or six pairs of plates, having zinc and copper for its metals, would consist of zinc and copper alternately, commencing with one and terminating with the other. On the contrary, I arrange the metals of my battery or pile so that the same metal marks the commencement and termination of the series. In each pile or battery I have also an odd number, the central plate constituting one of the poles; or the two central plates are of the same metal, and united together.

The drawings show a pile or battery of fourteen cells. The metals employed are zinc and copper. By my peculiar arrangement the metal zinc commences and terminates the series, while the two central cells are occupied by a pair of copper plates instead of plates of zinc and copper. These two copper central plates represent one of the poles of the battery or pile, and are, in fact, the receptacles of the electric forces proceeding from the two extremities.

The form of my battery or pile may be varied, as well as the material of which it is constructed. Thus a battery or pile may be formed by the union of a number of such batteries as described, terminating in one common central cell.

The usual acid or saline solutions now employed in the common batteries may be applied to mine as well.

The same novelty of arrangement, as far as metals are concerned, which I have introduced into my pile or battery I apply to the construction of wires intended for the conduction of electricity, by which means I obtain a more perfect degree of insulation. The same principle is also applicable to the preservation of metals from oxidation or corrosion, or, in other words, to the galvanization of metals.

I may mention that my battery may be constructed with cylinders as well as with plates and cells.

Having thus described my improvement in the construction of a pile or battery, I now proceed to explain other portions of the invention.

Electro-chemical force, accompanying combination and decomposition, may be with great advantage employed in the treatment of vegetable bodies—as, for example, in the fertilization of seeds. Thus, to produce rapid and healthy germination, I steep the seed in some compound such as carbonate of potash, or in some suitable alkali. I then transfer it to a bath of weak acid, by means of which the carbonate of potash is decomposed, and carbonic acid set free. I can use any acid, but I prefer such as phosphoric or nitric, because they unite with the alkaline base to form fertilizing salts.

On the contrary, to preserve vegetable materials such as seeds, tissues, or fibres, I endeavour to set up the law of simple combination within them, avoiding the slightest decomposition. Thus, by dipping seed or any vegetable matter in a weak acid, and then in some basic hydrate for which that acid has an affinity, I retard or prevent entirely germination, fermentation, or eremacausis. In setting up this electro-chemical action, I generally choose such acids and bases which, when united, form well-known antiseptic salts or compounds. This process differs very materially from all others where antiseptics are used, inasmuch as I form the compound within the materials sought to be preserved. Thus, for example, to preserve fishing-nets, I dip

them first in some suitable acid such as tannic acid, and then in some hydrate such as soda, lime, magnesia, or alumina. To preserve animal matter such as meat, I adopt the same principle, forming the antiseptic compound in the meat itself. The same process, or one analogous to it, I employ for the prevention of disease in potatoes. Also to deodorize materials such as sewage matter, &c., I produce in them certain antiseptic compounds such as before mentioned.

To preserve membranous substances, such as skins and hides, I likewise cause the tannic acid, or other suitable acid, to combine with a suitable base within the tissues of the skin. In preserving skins by means of these tannates, I prefer the employment of some base like magnesia, which, when combined with tannic or catechuic acid, does not discolour the material.

By forming within the tissues and fibres of paper, cloth, &c., certain salts, such as sulphate of alumina, chloride and borate of zinc not only preserve them, but render them less combustible.

I produce two very opposite effects by the peculiar method in which I set up the electro-chemical action, to which reference has been made; or in other words according to the direction in which I cause the electric force to pass. Thus, if I merely produce chemical combination within the substance by the simple union of two bodies, such as an acid and a hydrate, and especially if that hydrate be potash or soda, I produce an effect similar to milling or fulling; but, on the contrary, if I establish decomposition within the fibre or fabric, whether by the usual method of decomposing a carbonate by an acid, or by fermentation, I cause an expansive effect to occur.

By forming within the fibres or fabrics certain salts insoluble in water, and then exposing them afterwards to decomposition by some suitable agent, I produce a singular cleansing and bleaching effect, dependent, I believe, upon the establishment of electrical currents during the solidification or crystallisation of the insoluble salt and its after solution. For example, if I saturate flax in a solution of sulphate of magnesia, and then dip it into a liquid holding dissolved in it an amount of carbonate of soda, an insoluble carbonate of magnesia is formed within the fibre itself. On immersing this in weak sulphuric acid, the carbonate of magnesia is decomposed, sulphate of magnesia is again formed, and at the same time colouring matter is removed to a considerable extent.

For the purpose also of cleaning and purifying saccharine syrups, oils, and fats, I use, for example, a solution of sulphate of magnesia, and then add lime-water. In this way two insoluble bodies are formed, and in addition to the electrical action set up, the mechanical effect of the insoluble matter will be to carry down to the bottom of the vessel certain impurities. In some cases I prefer the use of acetate of magnesia, precipitating the magnesia afterwards by the use (for example) of free carbonic acid passed into the syrup or oily matter. I also employ the acetates of such metals (lead excepted) the bases of which can be precipitated and removed by filtration, such, for example, as the acetates of lime, baryta, strontian, &c. I also employ for the purification of saccharine matters, and of fatty hydrocarbons, certain insoluble compounds of boracic acid with a metallic base, combining them in the material to be purified.

Metals may be rendered harder or softer also by means similar to those which have already been described. Remarkable changes are produced in iron by the formation in contact with it of the carburet of magnesium, for example, as well as by the production or decomposition of water, and of other compounds in a like situation of contact. The conversion of iron into steel is much promoted by the action of carburet of magnesium.

I apply also the same principle in the preparation of hydraulic cements, and for the purpose of hardening certain minerals and soft, porous stones.

Thus, in preparing a hydraulic cement, I add to the usual materials certain proportions of alum, lime, and soda-ash, by which means I obtain alumina, and a mixture of carbonate and sulphate of lime and of soda. The soda is easily removed by the action of water.

To harden soft, porous minerals, I use (for example) chloride of calcium and sulphate of magnesia, by which means I impregnate the stone with sulphate of lime, from which the chloride of magnesium is easily removed by water; but I can use any materials which will form within the stone or mineral an insoluble compound. For this purpose I sometimes employ soluble silicates, from which within the stone, I precipitate the insoluble silica. I also throw down in the materials to be operated on certain insoluble borates such as the protoborate of iron, &c.

To obtain basic zinc for painting purposes, I propose to obtain carbonate, borate, or chloride of zinc by the process of double decomposition. Thus, to obtain the carbonate, I react on sulphate of zinc by means of carbonate of soda or some similar carbonate. After the insoluble carbonate has been precipitated, I wash out and collect the sulphate of soda. If it is necessary, I now expose the carbonate of zinc to heat. In preparing certain animal fibres, such as

silk for spinning and dyeing, I find it of great importance to boil or steep first in some carbonate such as carbonate of soda, potash, or ammonia, and then to steep it in some weak acid; and for this purpose sour rice-water or starch-water is useful. Boiling or steeping silk also in a solution of biborate of soda, and the treating with a weak acid, as before, will be found efficient.

And having now described the nature of the said invention, and in what manner the same is to be performed, I declare that I claim the improvements in the application of electro-chemical action to the purposes hereinbefore described."

WEEKLY LIST OF NEW ENGLISH PATENTS.

Samuel Morris, of Stockport, for certain improvements in steam boilers. June 3; six months.

William Haughton, of Manchester, for improvements in machinery for spinning cotton and other fibrous substances. June 5; six months.

Robert Hardman, of Bolton, for improvements in looms for weaving. June 5; six months.

Laurent Machabee, of Avignon, for an improved composition applicable to the coating of wood, metals, and other substances to be preserved from decay. June 8; six months.

Edme Augustin Chameroy, of Paris, manufacturer, for certain improvements in steam engines. June 8; six months.

Enoch Townend, of Keighley, for certain improvements in the manufacture of textile fabrics. June 8; six months.

William Gratrix, of Salford, for certain improvements in the production of designs upon cotton and other fabrics. June 8; six months.

William Rettie, of Aberdeen, for certain improvements in lamps and burners, in apparatus for ventilating apartments, and in the mode of working signal lamps. June 8; six months.

Henry Houldsworth, of Manchester, for improvements in embroidering-machines, and in apparatus used in connection therewith. June 10; six months.

Thomas Wilks Lord, of Leeds, for improvements in machinery for spinning, preparing, and heckling of flax, tow, hemp, cotton, and other fibrous substances, and for the lubrication of the same and other machinery. June 10; six months.

William Beasley, of Kingswinford, for certain improvements in the manufacture of metal tubes and solid forms, and in apparatus and machinery to be employed therein. June 10; six months.

Michael Joseph John Donlan, of Rugely, Staffordshire, for improvements in treating the seeds of flax and hemp, and also in the treatment and preparation of flax and hemp for dressing. June 10; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
June 3	3281	E. Windsor	Lille, France	Gill machinery.
4	3282	P. Lawson and Son	Edinburgh	Box-edging cutter.
4	3283	J. J. Ball	Wenlock-road, City-road, Master R N	Disengaging apparatus for lowering boats from ships' sides at sea.
5	3284	J. Barnett	Birmingham	Apparatus for heating water.
,,	3285	T. Bland	Birmingham	Cover for vessels.
,,	3286	W. Smith	Bucks	Subsoil plough and stirrer.
7	3287	W. Dray and Co.	Swan-lane, Upper Thames-street	Chaff and litter-cutting machine combined.
,,	3288	J. Tucker and J. E. Saunders	Charlton, Kent Gracechurch street	Inflated water-proof tent.
,,	3289	W. Bridson	Liverpool	Plate and dish warmer and meat cooler.
8	3290	T. F. Griffiths	Birmingham	Gold-washing and detecting machine.

CONTENTS OF THIS NUMBER.

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Edited by J. C. Robertson, 166, Fleet-street.

DR. KEMP'S ELECTRO-MAGNETIC ENGINE.

Fig. 2.

DR. KEMP'S ELECTRO-MAGNETIC ENGINE.

(Patent sealed July 3, 1851. Specification enrolled July 3, 1852.)

By the Inventor.

It is well known that an electro-magnet is capable of sustaining an immense weight and that, by conjointly increasing the numbers of the helical coils and the amount of electro-motive force, at the same time using precautions to lessen the external resistance occasioned by great lengths of wire, an amount of attractive force can be attained, the maximum of which has not yet been arrived at; whilst, so far as researches have been made, we are justified in concluding that, by attention to the known conditions, any amount of sustaining force may be obtained.

It is also a fact that, on interrupting the contact between the electro-magnet and body sustained by it, the attractive force decreases very rapidly with the distance, and that but a very small intervening space can be permitted, if it be proposed to make use of this force as a motive power.

The object of the form of electro-magnetic engine delineated in the accompanying figures, is to transfer the greatest amount of force that can be economically obtained to machinery, by means of an hydraulic apparatus.

Fig. 1, represents a system of cylinders and pistons, so arranged that, on applying any force to the piston-rod *a*, and causing it to descend, the connecting-lever *b*, will also cause the rod *c* to move in the opposite direction, and, in so doing, any fluid above the piston *d*, and under the piston *e*, will be forced through the valves placed on the valve plate into the channel *h*, thence passing into the longer cylinder and driving down the piston *i*, which, by means of a piston rod and other usual contrivances attached to a crank and fly-wheel, causes this last to revolve until the piston *i* reaches the bottom of the stroke; the fluid beneath the piston being driven along so as to complete the fluid circle, each stroke of the pistons *d e*, causing the fluid to enter the shorter cylinders, by means of valves suitably arranged in the valve-plate, the lower passage constantly supplying the fluid to the smaller cylinder, whilst the upper passage at the same time supplies the fluid to the longer cylinder,—the upper valves preventing its return in an opposite direction. On the piston *i* reaching the end of the down stroke, a sliding valve or system of cocks, interposed between the two systems of cylinders as *k*, is caused, by a tappet motion attached to the longer piston-rod, to place the upper portion of the longer cylinder in communication with the lower water channel, and causing the upper water channel to communicate with the under surface of the piston *i*, thus changing the direction of the stroke.

It is evident, then, that a succession of impulses given to the piston-rods in the shorter cylinders, causing them to move alternately to and fro, will transmit the labouring force to machinery with a power and velocity proportionate to the relative size of the cylinders, which may be varied according to the nature and uses of the machinery employed. The force thus sought to be transferred is that of electro-magnetism, applied as follows:—

Fig. 2 represents a section of armature plates, attached to the lower ends of the piston-rods *a* and *c*; these plates are perforated so as to permit the rods of the armatures 1, 2, 3, 4, &c., &c. (the number of armatures corresponding with that of the magnets employed), to move freely through them, the one end of these stems being attached to armatures, the other being provided with a screw, on which travels an adjusting nut, to regulate the distance of the armature from the magnet.

Let A and B represent two planes of the magnetic surface, and suppose the magnetic plane B to be in action.

No. 1 is attracted to the magnetic plane, touching which it recedes, in consequence of the continued action of No. 2, and so on, causing the armature-plate *d*, with the rod attached, to move through a space equal to the sum of the distances accomplished by all the magnets acting successively.

The current of the battery is now transferred to the magnetic plane A, the magnets, 3 and 4, acting in a manner similar to 1 and 2; and thus rapid reciprocating action is produced in the piston-rods *a* and *c*. *b* is a guide plate, interposed between the armature plates, to keep them in position.

The transference of the galvanic current may be accomplished in a variety of ways; the method shown being merely used for the sake of simplicity.

Fig. 3.

Let *m*, fig. 1, be the negative wire of the magnets acting upon the armature plate attached to piston-rod *c*, and *n* the negative wire of the magnets acting on the other plate; on a small pillar of ivory or hard wood, placed in any convenient position with reference to a projecting-rod *o*, fastened to piston-rod *c*, are placed two pieces of square copper wire, *p*, *q*, which are connected with the conducting wires, *m* and *n*. The wire *r*, connected with the platinode of the battery, is caused to communicate, by means of an amalgamated surface, with the copper-slide *s*, which, by means of the projecting-rod *o*, is caused to be in alternate communication with *p* and *q*, according to the position of the piston-rod *c*. The whole of the other

conducting wires are attached to the zincode of the battery, and thus the magnetic surface will be determined by the position of the piston *c*; if at the bottom of the cylinder, the magnets in action will be 3 and 4, and *vice versâ*.

Fig. 3 represents a section at right angles to fig. 1, showing the mode adopted in the original model for securing parallelism in the piston-rod of the longer cylinder, and the rectangular series of magnets.

A machine thus constructed has the advantage of employing the maximum of magnetic force; the same amount of electro-motive force, and number of helical coils producing far greater effect than when used to develope machine action by means of the tendency of a bar of soft iron, or a steel magnet to place itself in a condition of magnetic equilibrium, as in Professor Page's Engine.*

It possesses the still farther advantage of involving such principles as are well known to the practical engineer, and resolves the whole question into two simple problems, which are easily solved.

1st, As to the *Unit of Power.*

It may safely be assumed that no question will be raised as to the capability of transferring any force by means of non-elastic fluids, or practically such confined in closed vessels: the point, then, to be determined is confined to the power sought to be transferred; and this can at once be accomplished, by bringing an armature as closely as possible to the surface of an electro-magnet without actual contact and testing its attractive force, by means of a dynamometer; the armature is now removed to such a distance as may indicate the minimum power proposed to be employed; the mean of these will give the actual force it is capable of exerting in an ordinary stationary engine with fly-wheel; the length of stroke required will regulate the number of magnets and moveable armatures.

It will at once be seen that moveable armatures, thus applied, are capable of producing any length of stroke without any hydraulic apparatus; but this arrangement would not be economical in a long stroke, as many of the magnets would thus be idle through a large portion of the stroke, when they could be economically applied by taking advantage of the extreme velocity with which the galvanic action is conveyed, and the mode of transference proposed.

2nd, As to the *Unit of Economy.*

Having determined the amount of surface and arrangement of battery capable of producing the force required, the positive metal is weighed, again transferred to the battery, the conducting wires of the magnet properly connected with it, and thus left for a given time; at the termination of which the positive metal is again weighed, and the amount of loss determined.

The *Unit of Consumption* is thus obtained; but not *the Unit of Economy.*

If iron be used as the positive metal, the value of the sulphate of iron formed must be deducted from the waste of material; and if zinc be used, the increasing consumption of the insoluble salts of zinc, as pigments, will no doubt render the value of the sulphate an important set-off against the expense of batteries employed on a large scale.

The entire safety of electro-magnetism as a motive power, and the immense economy of space, will also be given their proper position, by every unprejudiced person, in calculations made on this subject.

The case taken as an illustration is from the original model, and is merely adopted for the sake of convenience; a form of disc will now be preferred in general to the larger cylinder, and each individual bar of soft iron is, in the later arrangements, demagnetised immediately as its duty has been performed, thus very materially increasing the economical effect of the machine.

GEORGE KEMP.

Chiswick, June 7, 1852.

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* Many valuable deductions on this subject may be made from Professor Faraday's recent researches brought forward at the Royal Institution, January 23, 1852. It is clear that the power of an electro-magnet is proportionate to the number of magnetic curves or lines of force intersected.

CONVERSION OF SHALLOW INTO DEEP DOCKS.

Amongst the little-noticed inventions of Sir Samuel Bentham, is that of enabling "*shallow* docks to be made to answer the purpose of deep ones;—namely, by an artificial rise given to the water in a basin, in a lock, or in the dock itself." This expedient has been exemplified in Portsmouth Dockyard for half a century, his first proposal of it having been so early as in a letter to the Admiralty, May 29th, 1795, wherein he said: "In the instance of docks made or to be made within the basin, there would be no need for deepening them if means were provided for raising the water to the requisite difference of height within the basin. This might be done at a trifling expense by the same contrivance which I shall hereafter have to propose for pumping the water out of the bottom of the docks."

This proposal, made in the last century, and carried into execution, contained, moreover, in the first place the substitution of steam power for that of horses; secondly, of pumps which, by direct action, should pump water *out* of a basin or of a dock, or by *reversing* the action of those same pumps, they should be enabled to *raise* water *into* a basin or a dock. For these purposes, according to his plans, chain pumps were provided, each of them of no less a diameter than two feet. They were of simple construction; consequently, besides their small original cost, they wore well, and raised water with little loss from friction. Their chief peculiarities were in the form of the chain, and that was of gun-metal for the sake of durability,—a material that was found in this case, as in the chain of the steam-dredging apparatus, to answer the intended purpose most completely.

The important object Sir Samuel had in view in this work, as in that of carrying down the entrance of the basin to the greatest depth at which a ship could enter Portsmouth Harbour, was the enabling them to be docked with *all in*, that is, without the need of clearing them out and dismantling them before they could be taken into dock, and after repair, of refitting and reloading them, and further to obviate the delay occasioned in most cases by having to wait for spring tides, a delay not unfrequently amounting altogether to three, four, or even five weeks. Since his works have been completed, ships have been taken straight from sea into the basin, water has been raised in it, large as it is, at the rate of six or eight inches in height per hour, the vessels have been docked, examined, petty repairs made to their bottoms, and all so expeditiously that they have been enabled to go to sea again the second or third day after coming into harbour.

True, the importance of such works is less considerable in regard to a commercial vessel than to one of war, although on many occasions they might save considerable demurrage of the private trader. But in cases where badness of soil prevents, or renders very costly, the carrying on works of sufficient depth for deep docks, the expedient of pumping into them is not less desirable in private establishments than in naval arsenals. In many instances docks might by this means be made where otherwise they might be looked upon as unattainable on account of expense of excavation or badness of the ground. At Sheerness, for example, docks carried no *deeper* than necessary for frigates might, by this expedient, be made suitable in point of depth for ships of the line, the expense for pumping into them would be less than for towing vessels by steam tugs up to Chatham, and similar considerations are applicable to private dockyards.

But supposing the depth of a dock to be sufficient for floating a vessel into it, it might not admit of her being raised upon blocks. Here, again, by pumping water into the receptacle, its deficiency of depth might be easily and cheaply obviated.

M. S. B.

HOW TO MAKE VESSELS DRAW LESS WATER THAN USUAL, BUT AT THE SAME TIME TO BE MORE WEATHERLY, SO AS TO LIE MUCH NEARER TO THE WIND.

(From the Unpublished MSS. of Sir Samuel Bentham.)

The advantages derivable from the shallowness of a vessel are too obvious to require detail, as it enables it to navigate shallow waters; but depth seems to have been looked upon as necessary for the prevention of driving to leeward. Depth is also deemed essential to the

enabling a ship to sail to windward, although it causes increased resistance to progressive motion. Stowage room has also afforded an additional reason against diminution of bulk depthwise, especially as in vessels of war a considerable extent of bulk above water is required for the accommodation of officers, which, if not accompanied with considerable bulk under water, would render a vessel deficient in stiffness as well as in lateral resistance.

Sliding keels have hitherto been found the most effectual means for preventing vessels, particularly shallow ones, from driving to leeward; but the smallness of the surface they present against leeway, the great depth to which they must be protruded to increase their surface, added to increase of their thickness to obtain strength, are sources of resistance to progressive motion,—a resistance which is farther increased by a number of distinct keels. Farther objections to this expedient are the difficulty of making the keel-cases watertight, and the hindrance they cause to stowage, so that altogether these disadvantages seem to have caused the abandonment of sliding keels.

Lee-boards applied on the outside of a vessel, one on each side of it, are used with great advantage in the case of flat-bottomed barges for internal navigation in England, and very generally in Holland for sea navigation, where shallowness is requisite; but these lee-boards present only small surfaces, although much extended depthwise, consequently, for strength, require thickness, thus impeding progressive motion.

In lieu of the ordinary lee-boards, I should propose them to be as long as the side of the vessel can be continued straight. They might be in one continued mass, but more conveniently in separate pieces. They might be kept in contact with each other, and they might be made to slide perpendicularly up and down. Should the one to leeward alone be used, it would require only that the upper end should be held against the vessel's side; but if the lower end also were to be held sufficiently firm against the vessel's side, the lee-boards on both sides might be used, the one to windward as well as that on the lee side, and consequently a less depth of protrusion would suffice.

The lee-boards to a vessel of, say 100 feet long, might extend sixty or seventy feet; although its sides might tumble out, the lateral resistance of these boards would be but little diminished; especially as the direction of that on the windward side would be in a very favourable direction.

Such lee-boards, when drawn out of their places, might be made to answer several collateral purposes, such as that of assisting at landing. In their places they would afford some additional protection against shot, and some facility for stopping shot holes.

Although if iron were used as dovetailed bars for the lee-boards to slide between, those bars might be thinner than if of wood, it seems better to make them of the latter material.

Lightness being an essential quality in shallow vessels, all unnecessary thickness of plank should be dispensed with. If the vessel be of wood its fastenings should be treenails.

The *frame* of a light, shallow, vessel might be of iron, comprehending timbers, beams, and pillars, with due scarfs, and so as to require only a planking of wood against shot; and for security against leakage, an intermediate coating of elastic gum-cloth.

Double vessels having more space breadthwise for stowage than single ones, need not be high above water to gain space for men.

No other boats on board a transport for troops than such as at the same time are suitable for the conveyance of ammunition on land—that is amphibious baggage wagons—the covers of which, as well as the boat wagons themselves, serving when afloat for the conveyance of men.

Great guns during a voyage might, mounted on their carriages, be either below deck or upon it as occasion might require. If below, means might be provided for either drawing them up an inclined plane, or for hoisting them up.

THE EXCISEMAN'S STAFF QUESTION.

Sir,— In common, no doubt, with many of your readers, I have been much interested in the discussion respecting the Exciseman's Staff, and have looked with some anxiety for Mr. Smith's reply to Mr. Tebay's remarks on the solution given by the former gentleman in No.

1502 of this Magazine. The circumstance of Mr. Smith having made *friction* to *increase* or *diminish* the *weight* of the staff was certainly a *novelty* in mechanics, and I was hence very desirous of ascertaining whether this was the "mechanical *principle* [so] exceedingly valuable in itself," but upon which, although "every practical engineer should be well acquainted" with it, I had never the good fortune to stumble during the course of a long experience.

Mr. Tebay, I conceive, pointed out the *fallacy* of this *principle* in his brief reply to Mr. Smith (p. 444), which, from your last Number (p. 474), appears to have had the effect of causing Mr. Smith to *forget* his country, his place of residence, and the last four letters of his name; and although he *re-asserts* the correctness of his *views*, he very wisely refrains from offering any sort of *proof* of the truth of his own equation of moments (3) upon which the correctness or incorrectness of the whole discussion hinges.

Mr. Smith's equation is,

$$W.PM \pm F = B.PN \ldots (3);$$

where W, F, B, are the forces, and PM, PN, the perpendicular distances from the centre of moments P, upon the directions in which W and B act. Now F acts *at* the point P, and it appears to me that the perpendicular distance of its direction from P is *zero*. I am, therefore, at a loss to account for the presence of the term $\pm (W-B) \sin. \theta$, in the equation at the top of p. 405, since this appears to involve the contradiction *zero* $\times F = F = \pm (W-B) \sin. \theta$, and it seems hardly fair to your readers that Mr. Smith should tell them he feels "no inclination to enter into a controversy," when so important a point remains undetermined. He was the *first* to declare that the question "is still open to discussion," and I did hope he would at all events attempt to justify his own equation of moments before he decided *not* to "trouble you with any further remarks upon it." Perhaps he may be prevailed upon to relax this *premature* determination, and previously to enforcing his *profitable* recommendation to Mr. Tebay endeavour to convince your readers by *proof* that he himself is not "deep in the mud." I am, Sir, yours, &c., MECHANICUS.

June 14, 1852.

THE RIVER AMAZON.—GREAT PROJECT.

When Lieutenant Maury says anything, everybody may be sure it is something new, something striking, something to the honour of himself, and to the benefit of his country. He has recently presented a singular memorial to the Senate and House of Representatives, which embraces new and varied information, and he proposes a new national enterprise, which, if carried out, will give the United States an impetus in trade and commerce, and produce as decided an effect upon our national prosperity, as the possession of the East Indies has upon Britain. But let us quote some extracts from the memorial:

"On account of the currents which flow through, and the winds which blow over, the Gulf of Mexico, the Gulf of Mexico is, for many of the practical purposes of commerce and navigation, a closed sea. Hence commercial men and navigators have maintained that the real outlet of the Mississippi River to the ocean is not at the Belize, but in the Straits of Florida.

"Similar agents have placed the commercial mouth of the Amazon, not where that river empties into the ocean, which is under the equator, but they have moved it far into the northern hemisphere, and placed it near the commercial gateway of our own Mississippi.

"If the drift-wood of the Andes, in the interior of South America, be set afloat upon the head waters of the Amazon, and if another log be felled from the Rocky Mountains, in the interior of North America, and cast upon the head-waters of the Missouri, these two pieces of drift, taken to represent the currents of their rivers, and into which they empty, will each, obeying the force of the winds and set of the currents, be drifted out upon the broad ocean through the Florida pass.

"The prevailing winds at the mouth of the Amazon are S. E. trade winds, and no vessel coming out of the mouth of that river can stand to the southward on account of the land, nor to the eastward on account of the winds and currents, both of which are directly in the teeth of all sailing vessels that attempt to steer such courses.

"Passing a few leagues to the north, the outward bound Amazonian then enters the region of the N.E. trade winds, which compel her, unless she be bound into the Carribbean Sea, to stretch off to the northward and westward until she passes through the region of the N.E. trades, and gains the parallel of 25° or 30° north, by which time she finds herself off our own coast.

"Now, this is the course of all vessels under canvas from the Amazon, whether

they are bound to the Rio de Janeiro, in Brazil, to India, or to Africa, or any of the markets of the Pacific around Cape Horn, or to the commercial marts of Europe. Be their destination what it may, unless it be along the Spanish main or through the Carribbean Sea, they must first steer north to cross the belt of N.E. trades, and in doing so they must pass our doors.

"Therefore, for the peaceful and practical purposes of commerce and navigation, there is but one highway from the mouth of the Amazon. On that way the Southern Atlantic ports of the United States occupy the position of half-way houses on the great market-way that is some day to lead from the valley of the Amazon to the rest of the world. The market-way we overlook. The winds and the waves have placed keys of it in our hands. Let us not, by non-use, suffer it to fall into the hands of others.

"If we regard the whole continent of America at one view, we observe that in the equatorial regions it is nearly cut in twain to receive an arm of the sea, skirted on the east by the chain of islands, the Great and Little Antilles, which extend from the peninsula of Florida on the north, to the mouth of the Orinoco on the south; that this land-locked arm of the sea is separated from the Pacific on the west by a narrow neck of continent called 'the Isthmus.' On the north this same arm of the sea receives the drainage of the valley of the Rio Grande, the Mississippi, and the Albama rivers; on the south the surplus waters of the Amazon, the Orinoco, the Magdalena, and Atrato, are emptied into it also. This sheet of salt water may, therefore, be treated of as an expansion of the Mississippi on the north, and of the Amazon on the south.

"Regarding this magnificent marine basin as a commercial receptacle, we may search the world in vain for another such feature in physical geography wherewith to compare it. It is unique. And for its commercial capabilities, it must for ever remain unsurpassed and unequalled.

"The valley of the Mississippi extends, according to the computation of physical geographers, over an area of 982,000 square miles, that of the Amazon and its confluents, with the Orinoco as one of them, embraces that vast area more than twice over. The great Amazonia valley is said by the same authority to cover an area of upwards of two millions of square miles in extent.

"The Mississippi river is computed to afford a littoral navigation of 15,000 miles in length, some put it down as high as 20,000. But the Amazon and its majestic tributaries wind through an inland navigation of such an extent that, if stretched out in one line, its extent would be enough to encircle the earth three times. It is set down as high as 80,000 miles. The Amazon is said to be navigable for vessels of the largest class up to the foot of the Andes. The *Pennsylvania*, 74, may ascend that high.

"And so traversed with navigable streams and water-courses is the great Atlantic slope of South America, that there are in it no less than 1,500 miles of 'furos' or natural canals, through which it is practicable for vessels to cross from one river over into another.

"Were this valley settled upon and subdued to cultivation, 'the Indies,' in a commercial sense, would thereby be lifted up and placed at our doors, for all the productions of the East flourish there; and so jealous and afraid of such a result was Portugal in her day, of East India possessions and commerce, that by a royal ordinance it became unlawful to cultivate in the great Amazon basin a single drug, spice, or plant of East India growth or production.

"The foundations of commerce rest upon diversity of climate; for without diversity of climate there can be no diversity of productions, and consequently no variety of produce, which begets barter, and thus gives rise to commerce.

"Imagine an emigrant—a poor labouring man he may be—to arrive from the interior of Europe, as a settler in the valley of the Amazon. Where he was, his labour could but support himself in the most frugal manner, and he was then no customer of ours. But in his new home, where, with a teeming soil and fine climate responding to his husbandry, and where the labour of one day in seven is said to be enough to crown his board with plenty, he works with his wonted diligence, and out of his own produce—coffee it may be, or drugs, or spices, or gums, or cocoa, or rice, or tobacco, or some other of the great staples of that valley; but be it what it may, he has enough to give largely in exchange with us for all the manufactured articles, whether of fancy, necessity, or luxury, that he craves the most. In the long list of what the emigrant there will require of us may be included that great assortment of goods known as "Yankee notions;" also pickled beef and pork, hams and flour, butter, lard, and the like; for the climate of the Amazon is not favourable to the production and stowage of any of those things. It is particularly unfavourable to the curing of meats and the grinding of flour; it is also unfavourable for all in-door occupations. And in the settling up of the valley of the Amazon, considering that New York and Boston are but eighteen or twenty days

under canvass from the mouth of that river; considering that the winds are fair for going and free for coming, and that the Atlantic ports of the United States are the only market-places for which the winds are thus propitious—considering all the physical advantages which we thus enjoy, and regarding this immigrant as the type of a class—it may be expected, whenever the tide of immigration, guided and sustained by American enterprise and energy, shall begin to set into that valley, that New York and Boston, with the manufacturing States, will have to supply those people with every article of the loom or the shop, from the axe and the hoe up to gala dresses and river steamers.

"The man, therefore, who in his native Europe could not buy a cent's worth of American produce, simply by being transferred as a settler in the valley of the Amazon, becomes at once a producer, and one of the best customers to American merchants that it is possible for a commercial people to have; and Europe is ready, as soon as the American commerce, backed up by American energy, shall give the world tangible evidence of the riches and resources of that country, to pour forth its hordes into it.

"American merchants, American ships, and American sailors, will therefore be the chief competitors for the fetching and carrying of all that trade to which, in process of time, two or three hundred millions of people in the valley of the Amazon, and which it is capable of sustaining, will give rise.

"The commercial future of that valley is the most magnificent in the world.

"It belongs mostly to Brazil, and our trade with Brazil is already greater than it is with any other country whatever, excepting only England and France.

"From the United States to Rio the voyage is long and uncertain, and our merchants are falling into the habit of conducting their Brasilian correspondence through England. There is a monthly line of steamers thence to Rio; its time of going is 29 or 30 days; the average sailing passage from New York to Rio is from 40 to 50 days. Hence it is more convenient for the business man to send his letters *viâ* England.

"Now, there is a line of steamers from Para, at the mouth of the Amazon, to Rio. A line from Norfolk to Para, equalling in speed the Collins line to Liverpool, would make the passage in eight or ten days. At the same rate the distance thence to Rio might be accomplished in another week or ten days, thus bringing that great commercial mart of South America within twenty instead of forty days of our business men.

"All the lines of ocean mail steamers that have yet been directly encouraged by the United States government on the waters of the Atlantic have their terminus in New York.

"No direct encouragement to steam-ship enterprise has been given by the government to any port south of New York.

"Your memorialist is opposed to centralization, and therefore for this, as well as for other reasons, prays that Norfolk or Charleston, or some other southern Atlantic port, may be made the terminus of a line of United States mail steam-ships to Para, touching at Porto Rico, and such other West India islands as may be agreed upon."

This is truly a magnificent scheme, and we hope it will be carried out in the course of twelve months.—*Scientific American.*

STEAM NAVIGATION IN AMERICA.

A petition has been presented to the American Congress by a person professing to be acquainted with steam navigation, who believes that he can construct an ocean craft which can neither be burnt nor sunk (even if stove against icebergs or rocks), nor blown up by its boilers, and which will average, in a voyage across the Atlantic, fifteen miles an hour, and he will undertake to build the vessel provided the Government will remunerate him in case of success. He asks Congress to make a provision, giving him and his associates, or their legal representatives, the sum of one millions of dollars upon condition of his producing such a vessel within five years from the passage of the Act, to be adjudged and reported on by a committee of five disinterested persons to be appointed by the President, on whose decision the Secretary of the Navy is to pay the money. The plan is, that the vessel is not to be less than 4,000 tons, 40 rods long, and six wide; to draw only from five to six feet of water when laden. She is to have two sets of boilers and engines, and four pairs of water wheels; is to be of iron entirely, with zinc finishing; the kelsons, ribs, &c., are to be of plate iron, corrugated where proper, and made air-tight, forming air-chambers. The floors or decks are to be double, having sectional air-chambers throughout, as will also the portions of the ship, including those forming the state rooms, cabins, &c., thereby rendering it impossible for her to sink. She is also to be subdivided by water-tight partitions. Although five years are asked, the memorialist says he can accomplish the work in two; and although the condition of speed is fixed at the moderate (?) rate of fifteen miles an hour, he has no doubt of accomplishing an average of from 20 to 25 miles per hour!!! besides having her shot-proof,

MR. BALL'S REGISTERED DISENGAGING APPARATUS FOR LOWERING SHIPS' BOATS AT SEA.

[Registered under the Act for the Protection of Articles of Utility. John Jennings Ball, Master, Royal Navy, Proprietor.]

Fig. 2. Fig. 1. Fig. 3. Fig. 4.

Description.

Fig. 1 represents part of a ship's side with a boat A, in the act of being lowered. Fig. 2 is an end view of the boat while suspended from the ship's side at the moment of being disengaged from the tackles. Figs. 3 and 4 are different views of the tackle blocks, by which the disengaging is effected. The mode of operation is as follows: Supposing the boat to be suspended from the davit-heads B B, by means of the tackling CC, then as the boat is lowered, the cord D, which is fastened to the top block by the eye E, and to the bottom block by the thimble or ring F, becomes tightened; the cord D is kept of such a length as to allow the boat almost to touch the water before it draws the ring F and catch G, fig. 3, over the point of the tongue, or catch H, which, when done, allows the catch H to be drawn down by the weight of the boat, as represented by the dotted line *a*, which thereby becomes disengaged. And as both lower blocks are fitted with the disengaging apparatus, by lowering alike at both ends of the boat the tongues are both relieved at the same time, and the boat allowed to drop gently into the water.

PROGRESS OF LOCOMOTION.

In England.— It is understood that a contract has been entered into by the Directors of the London and North-Western Railway Company with Messrs. Fairbairn, of Manchester, for the construction of a number of "express-train" engines, which have been designed by the Company's locomotive engineer for the attainment of high speed. It is fully expected that these engines, which Messrs. Fairbairn have undertaken to complete in four months, will run from Euston-square to Birmingham, a distance of 113 miles, with loaded trains, in two hours; and it is not, therefore, unreasonable to anticipate that, before the close of 1852, the important manufacturing and commercial districts of South Lancashire will be brough within an easy journey of three and a half hours of the metropolis.—*Times, June* 17.

In America.—They are making time on the Hudson River Railroad now, that beats the speed on any of the English railways. The 6 o'clock train out of New York, Saturday morning, the 15th instant, made the distance in three hours and one minute. The following is the running time:—From 31st street, New York, to Peekskill, 50 minutes; to Fishkill, 23 minutes; to Poughkeepsie, 20 minutes; to Rhinebeck, 20 minutes; to Hudson, 32 minutes; to Albany, 36 minutes; total 181 minutes. This is equal to about 50 miles an hour.—*Scientific American, May* 29, 1852.

PATENT CASES.

Vice-Chancellors' Court, Saturday, June 12.

(*Before Sir* G. TURNER.)

HANCOCK *v.* MOULTON—(SEE ANTE P. 456.)

The Vice-Chancellor gave his judgment on the motion to restrain the manufacture by the defendant of vulcanised or cured caoutchouc, alleged to be an infringement of the plaintiffs' patent. His Honour said that there were three questions discussed: first, the validity of the plaintiffs' patent; second, whether there had been, in fact, any infringement; third, whether the delay which had been allowed to take place precluded the Court from interfering by injunction upon this application. On the first question he had felt no hesitation. The plaintiffs' patent was obtained in 1843; it appeared to have soon come into extensive use, and there was no trace of any infringement until the year 1847 or 1848. Actions were then brought against two parties, who submitted and took licenses. Actions were subsequently brought against other parties, who did not submit. These actions were consolidated in one, and on that action a verdict was found for the plaintiffs. The right of a patentee was a legal right, and, like any other legal right, must be protected by injunction where the legal remedy would be insufficient. Length of time and uninterrupted enjoyment of a patent gave a colour of right, even if the right had not been tried at law. This principle had been affirmed in the case of the "Screw Patent," and had been sanctioned by the Lord Chancellor. In this case, therefore, if there had been no question of the infringement, and no difficulty arising from the delay, he should have been bound to extend to the plaintiffs the protection of the Court. The next question, then, was, whether a sufficient case of infringement had been established. The plaintiffs' patent was for a mixture of sulphur and caoutchouc, subjected to heat. The mixture was first made mechanically, and then, by the operation of heat, the character of the caoutchouc was changed in these respects—it ceased to be liable to stiffening from cold, it was not decomposed by heat, and it was improved in elasticity. The patent extended to the incorporation of sulphur, and sulphur only, with the caoutchouc by means of heat. Now, the defendant obtained a patent in 1847, and under that patent the process was the combination of hyposulphate of lead and artificial sulphuret of lead with caoutchouc; that combined mass, acted upon by heat, was alleged by the defendant to produce more beneficial results, but the results were of the same character as those which were produced by the plaintiffs' patent. The results were the flexibility of the combined substance, its freedom from liability to decomposure by ordinary heat, and its improved elasticity. Assuming the materials thus used by the defendant to be different, the process of the defendant would, *per se*, be no infringement of the plaintiffs' patent. The plaintiffs confined their patent to sulphur; the defendant had hyposulphate of lead and artificial sulphuret of lead. But it was alleged by the plaintiffs that the materials were not in truth different, or at least that the materials which produce the result are the same. It was said that the sulphate or sulphurets of lead do not of themselves produce the change, but that the change is produced by the sulphur which they contain, and which forms one of their several constituent parts, and that, those parts being decomposed by heat, the sulphur combined with the caoutchouc and left a residuum of lead, which had no operation in the change which was effected. If the qualities conferred upon the caoutchouc by the process were imparted by the sulphur, it would no doubt be an infringement of the plaintiffs' patent. He had examined the evidence on this point, and he was of opinion that the evidence preponderated very considerably in favour of the plaintiffs. He was very much better satisfied with the scientific evidence which had been adduced for the plaintiffs than with that which had been offered by the defendant. The plaintiffs' scientific witnesses were much more distinct, and went much more to the points in question than those of the defendant; and if he were bound to decide the case upon the scientific evidence which had been given, he should decide it in favour of the plaintiffs. He was, however, bound to consider that it was a question depending upon the principles of science; and, although the witnesses on behalf of the defendant had not satisfactorily developed the reasons upon which their opinions were founded, yet they had sworn that the materials by which the defendant produced his results were, in fact, different from those claimed by the plaintiffs, and that there was in truth no infringement on the material or process of the plaintiffs' patent; and he was also bound to take into account the fact that the evidence for the defendant asserted that there was a substantial difference in the character and qualities of the articles produced by the two processes; and if this were so, it must be inferred that there was a cause for this difference not explained by the existence of sulphur alone. The injunction of the Court should not be granted unless the Court was prepared to follow it up, if necessary, upon the same or the like evi-

dence, by a committal of the defendant for a breach of the injunction. The Court on a motion to commit a party for a breach of its injunction, by infringing a patent, ought to be satisfied beyond all doubt of such infringement before it deprived the defendant of the opportunity of submitting the question to a jury. Weighing all these considerations, and admitting the strength of the plaintiffs' evidence, he was of opinion that he should not upon the evidence be warranted in committing the defendant without a trial at law of the question of the infringement. There was, moreover, the third question, whether, supposing the infringement to have been proved, the Court should interfere by injunction, after the delay which had taken place. The defendant had obtained his patent in 1847. In 1848 he had taken a factory, and had actually commenced his manufacture in 1849. The plaintiffs in 1849, through Mr. Birley, entered into communication with the defendant, and inquired what he intended to do. The evidence for the defendant stated, that the defendant said he intended to work according to his patent. This was disputed. On the other side, the statement was that the defendant gave the plaintiffs to understand that he intended to work according to the American basis. The fact, however, was that the defendant had gone on working from the end of the year 1849, and he did not find any direct notice given to him by the plaintiffs that they intended to dispute his right to do so. He did not find that any application was made to the defendant until about March, 1852. The reason given by the plaintiffs for this abstinence was, that there were actions pending which they had brought against other parties. He would by no means say that a patentee was bound to bring actions in respect of every infringement; on the contrary, the Court would not refuse to grant an injunction against any infringer against whom no action had been brought, provided distinct notice had been given to him that the rights of the patentee would be enforced against him; but in such cases distinct notice should always be given that the party would be held bound by the result of the trial or trials which might be pending. In this case, also, the actions were brought against the vendors of American over-shoes. The defendant was not dealing with the same articles, and if he worked according to his patent, he was carrying on his manufacture by a different process. It was the duty of the plaintiffs to have inquired of the defendant, when he began working in 1849, whether he was working under the American patent, and to have informed him in that case, that they should hold him bound by the result of the pending trial; and if the plaintiffs were not satisfied with the result of their inquiry, and had reason to believe that the defendant was proceeding on a different process, they should have applied to this Court. On the question of delay, therefore, he was of opinion that the plaintiffs had not, as respected the defendant, proceeded with that promptitude which the course of the Court required. The case was one of great importance to the parties, and he had considered it with great anxiety, and he had come to the conclusion that he must refuse the injunction.

The motion was ordered to stand over, with liberty to the plaintiffs to bring an action, and to apply to the Court in case of any delay in trying the question at law. The defendants were ordered to keep an account, and the parties were to submit to mutual inspection of their works and processes.

Court of Chancery.—Westminster, June 12.

Re Fawcett's Patent.

Mr. Fawcett, a carpet manufacturer at Kidderminster, registered a new process for manufacturing carpets, a specimen of which was exhibited at the Great Exhibition last year. An application was then made by Fawcett for a patent, which was not opposed before the Attorney-General. Some time afterwards, however, Messrs. Humphrey and Co., carpet manufacturers of Kidderminster, claimed the invention as their own, and entered a *caveat* against the patent being granted to Fawcett. Sir W. P. Wood, the then Solicitor-General, certified that the inventions of Messrs. Humphrey and Co. overrode the whole scheme of Fawcett, and that, therefore, he was not entitled to a patent. A second *caveat* was afterwards entered by a person of the name of Beach, who had been in the employ of Fawcett and worked at the design, and who now claimed it as his own invention. The matter has been repeatedly before this Court.

Mr. Daniel and Mr. Woodhouse were proceeding to open the merits of the case on behalf of Mr. Fawcett, but were interrupted by

Mr. Campbell, who objected to the case being heard as an appeal from the law officers of the Crown. This rule respecting the jurisdiction of the Court had been clearly laid down by Lord Brougham and Lord Cottenham, and the only course open was to send the matter back to the Attorney-General for further investigation, and for him to report thereon.

Mr. Webster and Mr. Selwyn were on the same side.

The Lord Chancellor said that it was not the practice of the Court to hear cases relating to patents upon their merits, notwithstanding that Lord Eldon had in one instance (*Ex parte* Fox) departed from this rule. The rule was a most convenient one, and must be followed in the present case, as there was no reason to suppose that the opposition to the patent was in any way fraudulent. If the Court had had any cause to think otherwise, it would have heard the case in the recess in order to save delay. As it was, the order of the Court would be to send the matter back to the Attorney-General, with a direction not to delay hearing it.

AMERICAN PATENT LAW CASE.

(From the *Franklin Journal.*)

Circuit Court of the United States, Northern District of New York, Ross Winans v. the Troy and Schenectady Railroad Company.

Action at Law for the infringement of Ross Winan's Patent for the improvement commonly known as the Eight-wheel Railway Car.
Defences.—Want of Originality of Invention. Invalidity of Patent.—No Infringement.

This was an action for the infringement of a patent granted to Ross Winans on the 1st of October, 1834, for an improvement in the construction of cars or carriages intended to run on railroads. The suit was commenced on the 14th of July, 1847, and was tried at the term of the Circuit Court of the United States, holden at Canandaigua, June, 1850, before Judge Conklin and a Jury—Messrs. Spencer, Keller, and Blatchford for Plaintiff, and Messrs. Stevens and Buel for Defendant.

The nature of the improvement patented, is thus set out by the specification of the patent.

"The object of my invention," the patentee says, "is, among other things, to make such an adjustment or arrangement of the wheels and axles as shall cause the body of the car or carriage to pursue a more smooth, even, direct, and safe course than it does as cars are ordinarily constructed, both over the curved and straight parts of the road, by the before-mentioned desideratum of combining the advantages of the near and distant coupling of the axles, and other means to be further hereinafter described." This is the object of the plaintiff's invention as stated by him. He then goes on to describe the means he has invented to effect the object he has specified.

"For this purpose," says he, "I construct two bearing carriages, each with four wheels, which are to sustain the body of the passenger or other car, by placing one of them at, or near each end of it, in a way to be presently described. The two wheels on either side of the carriages are to be placed very near to each other, the spaces between their flanches need be no greater than is necessary to prevent their contact with each other. These wheels I connect together by means of a very strong spring—say double the usual strength employed for ordinary cars—the ends of which spring are bolted, or otherwise secured to the upper sides of the boxes, which rest on the journals of the axles; the larger leaves of the springs being placed downwards, and surmounted by the shorter leaves. Having thus connected two pairs of wheels together, I unite them into a four-wheel bearing carriage, by means of their axles and a bolster of the proper length, extending across, between two pairs of wheels, from the centre of one spring to that of the other, and securely fastened to the tops of them. This bolster must be of sufficient strength to bear a load upon its centre of four or five tons. Upon this first bolster I place another of equal strength, and connect the two together by a centre pin or blot passing down through them, and thus allowing them to swivel or turn upon each other in the manner of the front bolsters of a common road wagon. I prefer making these bolsters of wrought or cast iron; wood, however, may be used. I prepare each of the bearing carriages in precisely the same way. The body of the passenger or other car, I make of double the ordinary length of those which run on four wheels, and capable of carrying double their load. This body I place so as to rest its whole weight upon the two upper bolsters of the two before-mentioned bearing carriages or running gear. I sometimes place these bolsters so far within the ends of the body of the car as to bring all the wheels under it; and in this case, less strength is necessary in the car body than when the bolster is situated at its extreme ends. In some cases, however, I place the bolster so far without the body of the car, at either end, as to allow the latter to hang down between the two sets of wheels or bearing carriages, and to run, if desired, within a foot of the rails."

He then goes on to speak of some particular features of this invention, and finally he states explicitly, in a summary at the end of the specification, what he claims, and what he does not claim, as follows:—

"I do not claim as my invention the running of cars or carriages upon eight wheels, this having been previously done; not however in the manner or for the purposes herein described, but merely with a view of distributing the weight carried more evenly upon a rail or other road, and for objects distinct in character from those which I

have had in view, as hereinbefore set forth. Nor have the wheels, when thus increased in number, been so arranged and connected with each other either by design or accident as to accomplish this purpose. What I claim, therefore, as my invention, and for which I ask a patent, is the before described manner of arranging and connecting the eight wheels, which constitute the two bearing carriages, with a railroad car, so as to accomplish the end proposed by the means set forth, or by others which are analogous and dependent upon the same principles."

The defendant denied that Ross Winans was the original inventor of the improvement thus described and claimed. He contended that the description given of the invention was not sufficiently full and clear to enable others to use it,—that he had abandoned his invention before obtaining a patent; and lastly, that the defendant's cars were no infringement of the patent. The defendant introduced the testimony of a number of witnesses in support of these positions, and the plaintiff introduced a number of witnesses to rebut this testimony. Judge Conkling reviewed all the points raised in an elaborate charge to the jury.

After concluding his charge his Honour, Judge Conkling, in answer to several prayers for instructions, offered by the defendant's counsel, instructed the jury in substance as follows:

That it was undoubtedly true that a patent could not be taken merely for a purpose, end, or object, but that he doubted the pertinency of any instruction on that point in this case, because the patent here was not for a purpose, but for the means of effecting a purpose.

That the specification was sufficient, if the patentee had described a carriage susceptible of an attachment of the power to the body, and if the drawing showed such mode of attachment, and that the plaintiff suffered no disadvantage from not stating it in his written specification; and although the drawing was not to be taken into consideration for the purpose of measuring the extent of the claim, yet it might be considered in ascertaining whether what he claimed was new.

That the patent was valid, if the plaintiff's car was substantially, on the whole, a new and useful thing.

That if a thing substantially like the plaintiff's car had been described, prior to his invention, in some public work that had been produced, then the patent was not good: but that it was not enough that the description should merely suggest the idea of the invention.

That it was a question of fact for the jury whether the specification was sufficiently exact and intelligible in reference to the position of the trucks.

That, in order to find for the plaintiff, the jury must be convinced that what the plaintiff had patented is useful; but that any degree of utility was sufficient to support a patent, the word useful in the patent law being used in opposition to frivolous or noxious; and that with regard to the question of side-bearings, although the jury should think it better to have longer bearings than the plaintiff contemplated, that could not take away the utility of his invention, as it was not necessary that the thing patented should be the best possible thing of the kind that could be made.

That if the jury believe that the intermediate time between putting the Columbus into use, and the taking out of his patent, was devoted by the plaintiff in good faith to perfecting of his invention, he cannot be considered as having abandoned it; but that if the invention was perfected in the Columbus, there could be no need of farther experiment.

That, in order to warrant the jury in finding an infringement by the defendants, they must be shown to have used either the same thing, or substantially the same thing as the plaintiff's invention.

The jury found a verdict in favour of the plaintiff on both the questions of originality and of infringement.

A motion for a new trial was argued before Judges Nelson and Conkling, at the June term, 1851, of the Court, when Judge Nelson delivered the following opinion, denying the motion for a new trial:

NELSON, J., 1. I have examined the various grounds presented by the counsel for the defendants, on the motion for a new trial, and, after the fullest consideration, am of opinion the motion must be denied.

Most of the exceptions taken at the trial, and relied on in the argument here, are founded upon what we regard as an entire misapprehension of the thing claimed to have been discovered by the plaintiff, and for which the patent has been issued. This will be seen on a reference to the instructions prayed for by the defendants, upon which most of the questions in the case arise. They assume that if any material part of the arrangement and combination in the construction of the cars or carriages described in the patent was before known, or in public use, it is invalid; and hence various parts were pointed out by the counsel at the trial, and the Court requested to charge that if either of them was not new, the jury should find a verdict for the defendants.

Now, the answer to all this class of exceptions is, that the patentee sets up no claim to the discovery of the separate parts of the arrangement which enter into the construction of his cars. These may be old and well known, when taken separately and detached, for aught that concerns his invention. His claim is for the car itself, constructed and arranged as described in his patent. This, I think, is the clear meaning of the specification, and of the claim, as pointed out in it; proving, therefore, that parts of the arrangement and construction were before known, amounted to nothing. The question was whether or not cars or carriages for running on railroads, as a whole, substantially like the one described in the patent, had been before known or in public use, not whether certain parts were or were not substantially similar.

The argument presupposes that the claim is for the discovery of a new combination and arrangement of certain instruments and materials, by means of which a car is constructed of a given utility; and that if any one or more of the supposed combinations turns out to be old, the patent is invalid. This is the principle upon which much of the defence has been placed; but no such claim is found in the patent; no particular combination or arrangement is pointed out as new, or claimed as such. The novelty of the discovery is placed upon no such ground; on the contrary, the result of the entire arrangement and adjustment of the several parts described, namely, the railroad car, complete and fit for use, is the thing pointed out and claimed as new. This is the view taken by the Chief Justice of the patent, in the case of the present plaintiff, against the "Newcastle and French Town Turnpike and Railroad Company," tried before him in the Maryland Circuit, and which was adopted by the judge in the trial of this case.

2. It was further insisted on the part of the defendants, that if the relative position of the two bearing carriages to each other, constitutes a material part of the arrangement in the construction of the cars, the patent was void, unless the jury should find that the specification described with sufficient precision the location of these bearing carriages under the body of the car, so as to enable a mechanic of skill in the construction of cars to place them at the proper distance apart without experiment or invention. It was also contended that the remoteness of the bearing carriages from each other was not so described in the specification, as to constitute any part of the improvement.

In respect to this branch of the case, the Court charged that the relative position of the bearing carriages to each other, in the construction of the car, was a material part of the arrangement of the patentee, and left the question to the jury whether or not he had sufficiently described the position of the trucks, having in view their distance apart, and also from the ends of the car body, suggesting at the same time that the location must always depend, in a measure, upon the length of the body.

It will be seen, on looking into the specification, that the location of the trucks relatively to each other under the body, as well as the near proximity of the two axles of the truck to each other, form a most essential part of the arrangement of the patentee in the construction of his cars.

Great pains have been taken to point out the defects in the existing four-wheel cars; and the impediments to be encountered and overcome in the running of cars upon railroads, as the latter are usually constructed. The patentee states that in the construction of them, especially when of considerable length, it has been found necessary to admit of lateral curvatures, the radius of which is sometimes but a few hundred feet, and that it becomes important, therefore, to so construct the cars as to enable them to overcome the difficulties presented by these curvatures, and to adapt them for running with the least friction practicable on all parts of the road. The friction referred to is that which arises between the flanches of the wheel and the rail, causing great loss of power, destruction of the wheels and rails, besides other injuries. For this purpose, he constructs two bearing carriages, each with four wheels, which are to sustain the body of the passenger or other car, by placing one of them at or near each end of it, as particularly described. The two wheels on either side of the truck are to be placed very near each other—the spaces between the flanches need be no greater than is necessary to prevent their contact with each other. The car body rests upon bolsters supported on each of the two bearing carriages, or four-wheel trucks, the bolsters so constructed as to swivel or turn on each other, like the two front bolsters of a common wagon. The body of the car may be made of double the length of the four-wheeled car, and is capable of carrying double its load. The truck may be so placed within the ends of the car as to bring all the wheels under it, or without the end, so as to allow the body to be suspended between the two bearing carriages. The patentee further states that the closeness of the fore and hind wheels of each bearing carriage, taken in connection with the use of the two bearing carriages, arranged as distant from each other as can

conveniently be done for the support of the car body, with a view to the objects and on the principles before set forth, is considered by him as an important feature of the invention; for, by the contiguity of the fore and hind wheels of each bearing carriage, while the two bearing carriages may be at any desirable distance apart, the lateral friction from the rubbing of the flanches against the rails is most effectually avoided, while at the same time all the advantages attendant upon placing the axles of a four-wheeled car far apart are obtained.

The two wheels on either side of the bearing carriages may, from their proximity, be considered as acting like a single wheel, and as these two bearing carriages may be placed at any distance from each other consistent with the required strength of the body of the car, it is apparent that all the advantages are obtained which result from having the two axles of a fous-wheeled car at a distance from each other, while its inconveniences are avoided.

Among the principles stated by the patentee to be taken into consideration in the construction of the car is, that the greater the distance between the axles, while the length of the body remains the same, the less the influence of shocks and concussions occurring on the road; and hence the relief from them when the trucks are placed under the extreme ends of the body is greater than when placed midway between the centre and the end.

It is apparent from what we have already referred to in the specification, and still more manifest on a perusal of the whole of it, that the improvement in this part of the arrangement does not consist in placing the axles of the two trucks at any precise distance apart in the construction of the car, or from each end of the body. The distance used must necessarily depend somewhat upon the length of the car and strength of the materials of which it is built, and hence it was impracticable to specify in feet or inches, the exact distance from the ends of the car body at which it would be best to arrange the trucks. Neither do the advantages of a car constructed and arranged as described, depend upon the trucks being placed at a specified distance from the ends, or so that there may be a specified distance between the axles.

Having in view the defects in the existing cars, and other difficulties to be encountered, some considerable latitude may be allowed in this respect, consistent with the object sought to be attained, to remedy the defects in the existing cars. All the principles for the construction of the one, for the purpose of overcoming these difficulties, and remedying these defects, are particularly set forth in the description given by the patentee. We think the specification sufficient, and that the Court was right in the opinion expressed on this branch of the case.

Any mechanic of skill could readily arrange the bearing carriages in connection with the body of the car, so as to secure the advantages so minutely and clearly pointed out, and which are shown to attend the practical working of cars constructed in the manner described.

3. The questions of originality and of infringement were questions of fact, and depending upon the evidence, and were properly submitted to the jury. We think the weight of it decidedly with the verdict.

4. The patent in this case was originally issued 1st October, 1834, and was recorded anew, 7th of June, 1837, according to the Act of Congress of the 3rd of March, 1837, (5 St. at large 191). No drawings were attached to the original patent, nor was there any reference therein to drawings. On the 25th of September, 1848, the patent was extended for the term of seven years, from the 1st of October, 1848. The plaintiff gave in evidence at the commencement of the trial, a certified copy of the patent and specification, certificate of the extension, drawing with references to the same, and an affidavit of the plantiff, made November 19, 1838. The drawing was not filed at the time the patent was recorded anew, but was filed on the 19th of November, 1838. The counsel for the defendant objected to the evidence on the grounds; 1st, That it appeared that no drawing was annexed to the original patent; and 2nd, That the Act of Congress did not make such a drawing evidence. The Court also instructed the jury in summing up the case, that the drawing, a certified copy of which had been given in evidence, was to have the same force and effect as if it had been referred to in the specification, and was to be deemed and taken as part of the specification.

The first section of the Act of 1837, provides that any person interested in a patent issued prior to the 15th of December, 1835, may, without any charge, have the same recorded anew, together with the descriptions, specification of claim, and drawings annexed, or belonging to the same; and it is made the duty of the Commissioner to cause the same, or any authenticated copy of the original record, specification, or drawing which he may obtain, to be transcribed and copied into books of record kept for that purpose; *and whenever a drawing was not originally annexed to the patent, and referred to in the specification, any drawing produced as a delineation of*

the invention, being verified by oath in such manner as the Commissioner shall require, may be transmitted and placed on file, or copied as aforesaid, together with the certificate of the oath, or such drawings may be made in the office under the direction of the Commissioner in conformity with the specification.

The second section provides that copies of such records and drawings, certified by the Commissioner, or, in his absence, by the chief clerk, shall be *primâ facia* evidence of the particulars of the invention and of the patent granted therefor, in any judicial court of the United States, in all cases where copies of the original record, or specification and drawings, would be evidence without proof of the loss of such originals. This section also provides that no patent issued prior to the aforesaid 15th day of December, 1836, shall, after the first day of June, then next, be received in evidence in any court on behalf of the patentee, unless so recorded anew, and a drawing of the invention, if separate from the patent, verified as aforesaid, and deposited in the patent-office. See also section third of the same Act.

It is quite clear, upon the above provisions of the Act, that the Court was right in admitting the drawings in connection with the patent and specification in evidence. The whole together are made *primâ facie* evidence of the particulars of the invention, and of the patent granted therefor.

The weight to be given to the drawings furnished under the Act by way of enlarging or explaining the description as given in the specification, is another question. That will depend upon the circumstances of each particular case. As a general rule, they will not be effectual to correct any material defect in the specification, unless it should appear that they correspond with one accompanying the original specification for the patent, otherwise, in case of discrepancy between the drawing and specification, the latter should prevail. Care must be taken to avoid imposition by the use of the newly furnished drawing, and for this purpose the specification will afford the proper correction, unless the plaintiff goes further and shows that it conforms to the one originally filed.

The charge that the drawing in this case was to have the same force and effect as if it had been referred to in the specification, and was to be deemed and taken as part of it, was, perhaps, too strong, as it respects the drawings furnished under the Act of 1837. The principle is true as it respects those accompanying the original application for the patent, but can hardly be said to be applicable to the full extent stated in the case of these newly furnished drawings. The principle might open the way to imposition and fraud. Assuming that there is nothing but the oath of the party attesting that the drawing affords a true delineation of the invention, the specification should prevail in case of a material discrepancy. But admitting the instruction in this respect not to be strictly correct, and that too much weight was given to the drawing, we do not see that it would have altered the result. The specification afforded a sufficient description of the invention, independently of the drawing. Some slight additions, that improved the working of the car, were open to some question, whether they were embraced in the specification, but they did not enter into the essence of the invention, or constitute any substantial part of the improvement. Time and experience usually indicate these slight additions and alterations, and they should be regarded as consequential results belonging to the inventor. It requires time and experience usually to perfect the machine, and improvements derived therefrom are justly due to him.

5. As to the prior use of the car Columbus, and others constructed by the patentee before he made application for his patent, we think the instruction of the Court correct. The law allows the inventor a reasonable time to perfect his invention by experiments, and these could be made in this instance only by putting the car in the service of those controlling lines of railroads. There were repeated failures in the experiments tried, and the cars abandoned before the perfection of the car described in the patent. These experiments and trials sufficiently account for the previous use set up by way of forfeiture of the invention.

Upon the whole, after a careful examination of the case, and of all the points made by the defendants on the argument, many of which have been noticed above, we are satisfied that the verdict is right, and that a new trial should be denied.

The defendant then moved for "writ of error" to the Supreme Court of the United States, which was decided January 24th, 1852, negatively.

Counsel for the plaintiff then moved the Court at its late session for an injunction to restrain the defendant from further violating his rights, upon which motion the injunction was granted.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JUNE 17, 1852.

JOHN LAKE, of Apsley, Herts, civil engineer. *For improvements in propelling on canals and rivers.* Patent dated December 8, 1851.

Claims.—1. The employment in canal and river navigation of trackways, between or on which boats can travel without the aid of steersmen, and be propelled by means of steam or other elementary power.

2. A mode of obtaining a sufficient "bite" or adhesion for the driving wheels, by making use of a part of the weight of the boat and cargo, in which the engine is placed, for that purpose.

3. A method of sustaining the weight of a boat and cargo while in the course of transit, partly on the rails of a trackway laid down as aforesaid, and partly by the water of the canal or river as usual.

4. The employment in canal and river navigation of inclined planes for the passage of trains of boats from one level of the canal or river to another, constructed as described, and the working of the said planes by means of racks and pinions, actuated by the same engine as is used for propelling on the level.

JOSEPH HARRISON, of Philadelphia, now of Oxford-square, Hyde-park Gardens. *For certain improvements in steam engines and boilers.* Patent dated December 8, 1851.

The improvements, claimed under this patent, have relation to marine, locomotive and stationary boilers, and consist principally in extending the smoke-box into the boiler, in the use of tubes, through which the water circulates, while the flame and heat play on their exterior surface, and in the employment of vertical water tubes having flues passing altogether or only partially through them, so as to obtain within a given space as large an amount as possible of heating surface.

PETER ARMAND LECOMTE DE FONTAINEMOREAU, of South-street, Finsbury-square. *For improvements in the apparatus for kneading and baking bread and other articles of food of a similar nature.* (A Communication.) Patent dated December 8, 1851.

The "apparatus for kneading" dough consists of a semi-cylindrical trough within which is placed longitudinally an axis or shaft, to which are attached on the opposite sides two rows of radial arms, the arms on one side of the shaft being placed opposite the spaces between those on the other side. The ends of the arms of each set are connected together by rods parallel to the shaft which carry short arms projecting inwards towards the shaft, and placed between the long arms. The shaft is driven by a winch handle, and the action of the arms, when it is in motion, effectually kneads the dough contained in the trough without any of the disadvantages attendant on hard labour.

The "apparatus for baking" consists of a circular oven of an improved construction. The oven is provided internally with a revolving table on which the articles to be baked are placed, and this table is made to rise or fall, as may be required, to change the temperature to which the articles are to be submitted. The heat is applied externally, and continued without intermission during the baking operation. The bottom of the oven is heated by tubular flues under the moveable table; the sides by vertical flues which lead from the fire-place to the top of the oven, where space is left for the heat to circulate over the whole of it. Above the top flue, which is formed by two plates of metal, the oven is covered in with earth except at one part, where there is fixed a receptacle to contain water for the service of the kneading apparatus, and this water heated by the flames, &c., passing through the flue on top of the oven. A thermometer is applied to the exterior to show the degree of heat, and suitable dampers are provided for the regulation of the heat.

Claims.—1. The construction of a kneading apparatus composed of alternate long and short blades.

2. The giving a rotary motion and a rising and falling motion to the turn-table in the oven.

3. Constructing the top of the oven with parallel and horizontal plates.

4. Heating the bottom circumference and top of the oven by means of radiating horizontal heat and smoke conductors.

5. Constructing a reservoir for water on the top of the oven, and heating the same by the caloric of the oven.

PERRY G. GARDINER, of New York, civil engineer and machinist. *For improvements in the manufacture of malleable metals into pipes, hollow shafts, railway wheels, or other analogous forms, which are capable of being dressed, turned down, or polished in a lathe.* Patent dated December 8, 1851.

These improvements consist in manufacturing malleable metals into the above-mentioned forms by pressure between dies, to which a rotary motion around their axes is given in opposite directions.

When articles such as railway wheels or other circular forms are manufactured by simple pressure between dies, the metal is

found in many parts to be defective, and it does not possess a smooth surface. But by giving to each of the dies a rotary motion on its axis, the fibre of the metal will be laid in concentric rings, or in spiral lines, thus giving increased strength to the wheel, and a perfectly smooth and polished surface will be produced.

Again; in manufacturing lead pipes by the hydraulic press, the grain of the metal is laid in a longitudinal direction, and the pipes are in consequence liable to split under internal pressure, or when bent. But by the patentee's method of giving a revolving motion to the outer die, the grain of the metal will be laid transversely, and greater strength obtained than by the ordinary method. The patentee describes arrangements for carrying into effect each of these branches of his invention, and claims—

1. The manufacturing of malleable metals into pipes, hollow shafts, railway wheels, or other analogous forms, by the employment of a pair of suitably-shaped dies or swages, one or both of such dies or swages being made to revolve, and being gradually brought into closer proximity, whereby the mass of metal which is placed between them to be acted on is caused to assume the form of the article required to be made.

2. The arrangements and constructions of machinery described for carrying out the principle upon which the invention is based

RICHARD ARCHIBALD BROOMAN, of the firm of J. C. Robertson and Co., of 166, Fleet-street, patent agents. *For improvements in the manufacture of sugar, in the preparation of certain substances for such manufacture, and in the machinery and apparatus employed therein.* (A communication). Patent dated December 8, 1851.

CHARLES COWPER, of Southampton-buildings, Chancery-lane. *For improvements in separating coal from foreign matters, and in apparatus for that purpose.* (A communication.) Patent dated December 8, 1851.

Claims.—1. An improved apparatus for separating coal from foreign matters. (In its general structure this apparatus is similar to that described in the specification of a former patent granted to Mr. Cowper November 2, 1849, *see* vol. lii., p. 377.)

2. The application of a stream of water in the apparatus for classifying the coal, and the application of a fixed or stationary bottom plate to the same apparatus, over which the dust is carried by the aforesaid stream of water.

3. The application in the water-sifting apparatus for purifying coal of a perforated sheet of gutta percha, supported by bars, or by a frame or frames.

4. A mode of causing the schist and other impurities to leave the water-sifting apparatus, and enter a chamber from which they issue in a continuous stream.

5. A mode of purifying the fine powder, or dust of coal by means of a peculiarly-constructed labyrinth.

6. A mode of separating coal from foreign matters by means of a stream of water applied in the said apparatus.

THOMAS RESTELL, of the Strand, watchmaker. *For improvements in locks or fastenings.* Patent dated December 8, 1851.

The improvements claimed under this patent consist mainly in the application to tumbler locks of a circular guard around the spindle of the key-hole in combination with a moving shield, which prevents the introduction into the lock of more than one instrument at a time. They also include other arrangements for ensuring additional safety to combination locks, and to locks constructed on Bramah's principle; as well as the adaptation of a tumbler with safety guard and shield to latches.

WILLIAM PIDDING, of the Strand, gentleman. *For improvements in the treatment, manufacture, and application of materials or substances for building purposes.* Patent dated December 8, 1851.

This invention consists in certain combinations of broken stone, scoria, acetate of alumina, sulphate of alumina, mineral earths, fluxes, wood, sawdust, coal, coke, naphtha, vegetable fibres, papier maché, pitch, glue, gutta percha, and cements for the production of bricks and other forms of materials for building purposes.

The patentee lays no claim to any of the materials separately, but only to the combinations of them specified.

JAMES WEBSTER, of Leicester. *For improvements in drying gloves and other articles of hosiery.* Patent dated December 10, 1851.

These improvements consist in constructing the shapes or forms used for drying gloves and other articles of hosiery with internal partitions, so as to cause a circulation through them of the steam or fluid by which they are heated, and thus ensure an even temperature to every part thereof. The arrangement of partitions may be varied, provided it be such as to produce within the forms a circulation of the heated fluid.

Claim.—The making of shapes or forms for drying gloves and other articles of hosiery with means of producing circulation of the heated fluid therein.

JOHN FEARSON, of Birmingham. *For improvements in cutting, shaping, and pressing metal and other materials.* Patent dated December 10, 1851.

Claims.—1. A mode of combining parts into a machine for cutting out, and for shaping several discs or blanks of metal and other materials at one time, for the making of buttons and other articles.

2. Certain improvements in combining parts into machines for shaping and pressing metals and other materials in the processes of manufacturing them into various articles. [Under this branch of his invention the patentee describes three arrangements of machinery. The first is provided with a pneumatic feeder for supplying the strips of metal to the punches; the second is intended for punching sheaves from short tubes of metal, which are supplied by a mechanical feeding action; and the third is for manufacturing eyelets for healds and other purposes, by punching them from discs or blanks of metal.]

Specification Due; but not Enrolled.

ISAAC ALEXANDER, of 112 A, High Holborn, Middlesex, biscuit baker. *For a mode of preparing and treating certain kinds of cheese, whereby to render the same applicable to a variety of culinary and other domestic purposes.* Patent dated December 8, 1851.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Edwyn John Jeffery Dixon, of the Royal Slate Quarries Bangor, and Arthur John Dodson, of the city of Bangor, gentleman, for improvements in machinery and apparatus used in quarrying slate and stone; and in cutting, dressing, planing, framing, and otherwise working and treating slate and stone, and in apparatus and wagons used for moving and conveying slate and stone, and improvements in joining, framing, and connecting slate and stone. June 12; six months.

William Reid, of University-street, electric-telegraph engineer, and Thomas Watkins Benjamin Brett, of Hanover-square, gentleman, for improvements in electric telegraphs. June 12, six months.

Jean Ernest Beauvalet, gentleman, of Paris, for improvements in the manufacture of iron and steel. (Being a communication.) June 12; six months.

Joseph Brandeis, of Gt. Tower-street, Middlesex, for improvements in the manufacture of raw and refined sugar. June 12; six months.

George Pate Cooper, of Suffolk-street, Pall-mall East, tailor, for certain improvements in fastenings for garments. June 12; six months.

Thomas Restell, of Kennington, Surrey, watch manufacturer, for certain improvements in the construction of lamps and burners. June 17; six months.

James Norton, of Ludgate-hill, merchant, for improvements in apparatus for ascertaining and registering the mileage run by public vehicles during a given period; also the number of persons who have entered in, or upon, or are travelling in public vehicles; part of which improvements is applicable to public buildings and other places where tolls are taken. June 17; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
June 9	3291	J. J. Ball	Wenlock-road, City-road	Disengaging apparatus for lowering boats.
10	3292	J. Cooper	Towerhead, near Somerset	Compound geometric and spiral chuck for a lathe.
,,	3293	E. Bull	Halifax	High-pressure valve or stop-cock, for gas, water, or other fluids.

CONTENTS OF THIS NUMBER.

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1507.] SATURDAY, JUNE 26, 1852. [Price 3d., Stamped 4d.

Edited by J. C. Robertson, 166, Fleet-street.

NASMYTH'S DIRECT-ACTING STEAM SUCTION FAN, FOR THE VENTILATION OF COAL PITS.

Fig. 1.

NASMYTH'S DIRECT-ACTION STEAM SUCTION FAN, FOR THE VENTILATION OF COAL PITS.

Feeling, in common with the public generally, dismayed at the frequent occurrence of explosions in coal mines, and the consequent dreadful loss of life, and having understood that the highly distinguished James Nasmyth had invented an efficient apparatus for the ventilation of mines, I requested information on the subject, and have in consequence been assured that Nasmyth's "Direct-action Steam suction Fan, for the better Ventilation of Coal Pits," is now in successful action in one of Earl Fitzwilliam's coal mines.

The Davy Lamp has been considered as affording effectual security against the explosion of fire-damp; and so this scientific discovery would do were it possible to prevent abuse of the lamp, the delicate wire gauze that surrounds it being a complete defence against the ignition of the gas. Unfortunately that gauze is not proof against rough usage by coarse hands, and when broken through, its preservative power is lost. But it is not only accidental damage to which it is liable, for it is said to be often destroyed by piercing the gauze in lighting tobacco, and still more frequently that the lamp is opened for the purpose of its giving a better light, so that, when the surrounding air is foul, an explosion is the consequence, hurling into eternity all within its reach.

Now the object of the direct-action steam fan is to *remove the cause* of explosion, instead of attempting to guard against it in a combustible atmosphere—that is, by the fan, to insure perfect ventilation at all times throughout the whole of the mine; and, farther, to render that ventilation wholly independent of the too often reckless miner. This *desideratum* is obtained by placing the whole apparatus *above ground*, where it is open to inspection, and under the care and guidance of persons who can have no other interest than that of causing the fan to do its duty effectually.

Having been favoured with a sketch of the direct-action steam suction fan, I now forward the same. It will be seen from the engravings that the steam engine is in direct connection with the fan-spindle, the crank of the engine being fixed to one end of the fan-axle and the engine below. By this arrangement, all intermediate agents for the transmission of the power of the engine to the fan are dispensed with, the whole rendered most simple and compact, and highly efficient, as experience has now fully proved. The foul air is conveyed from the up-cast shaft to the fan by a tunnel T, which divides into two side passages, one on each side of the fan, as marked S S, they terminating in a circular aperture equal in diameter to half that of the fan-wheel or track of the blades; this action is so simple and self evident as scarcely to require any further description. The fan being set in rapid motion—say 300 to 400 revolutions per minute, as may be required—the centrifugal action induced on the air within the fan-case occasions this air to be flowing forth in the manner indicated by the arrows in fig. 1, namely, nearly in radial lines, while a partial vacuum is established about the centre part of the fan, to supply which the foul air rushes up by the side passages S S in volume equal to that which the centrifugal action of the fan flings forth. The volume of air which can in this way be drawn out from any mine or coal-pit has to be actually witnessed ere it can be duly credited; and when that is taken in conjunction with the great simplicity, compactness, efficiency, and manageableness of the apparatus, and that again with the vast economy of fuel, owing to the direct manner in which the force of the steam is made to attain the required object, this arrangement of fan for ventilating purposes it will be "*hard to beat.*"

It must be observed that there is no outward or circumference case or cover to this fan, which appears to be quite a novel arrangement, or at least is peculiar to this fan for ventilation purposes; this is attended with much economy of power, by reason of the perfectly free egress so afforded for the flinging forth of the foul air as quickly as it can rush into the centre of the fan.

It must further be observed that, supposing an explosion could possibly take place in a mine provided with this apparatus, it being on the surface of the ground, by means of it the power is obtained of instant re-ventilation, and thence of affording immediate succour to such unfortunates as might have retired to some safe nook where life had been preserved.

Fig. 2.

It is high time that some energetic movement should be made to arrest such wholesale destruction of life as late explosions have occasioned, and this by striking at the *root* of the evil, and carrying off explosive gas faster than it has been evolved under any circumstances hitherto recorded.

M. S. B.

SUPPLY OF WATER TO THE METROPOLIS.

Sir,—There is a general impression among Englishmen against meddlesome legislation. This arises from a consciousness that we are men of business, and can manage our own affairs. Parisians, on the contrary, like their minutest interests to be protected by the state; no government pleases them so well as that which touches everything. I was told in Paris, a short time ago, that a Frenchman could not wash his hands comfortably with a piece of soap which had not enjoyed the guardianship of the government. This, likewise, must be traced to the national character with regard to business. They love pleasure supremely, and distrust themselves in serious concerns. Notwithstanding this obvious difference, however, in the dispositions of the people, requiring a corresponding difference of legislative treatment, our government goes on, year after year, imitating French centralization and French interference, just as if there were the same individual incompetency on this side of the Channel as on that.

There is now passing through the House—or it may have already passed, I know not—a Bill for regulating and improving the supply of water to the inhabitants of the metropolis. Now it is very desirable, no doubt, to keep people honest—to compel monopolists, free from the wholesome influence of competition, to consider something beside their own narrow view of their own interest; but it is quite another matter to dictate the details of the mode in which the beneficial object is to be accomplished. "All Englishmen whatever detest extraordinary interference."—(The *Times*, 21st inst.)

Within three years from the passing of this Bill, all Water Companies will be compelled to make the supply "what is called constant." Is it possible that any practical man can have thought for one moment on this absurdity? Why, the thing is literally an impossibility! The frequent repairs of individual supply-pipes will render it frequently necessary to stop the supply of all. The *mains*, too, as we frequently see in our streets, will burst occasionally, and what is to be done while these are being repaired, if people have no cisterns? Suppose a supply-pipe bursts; the tenant sends for the landlord—the landlord sends for the plumber. He can do nothing while the water is *on*, and what are all the neighbours to do when it is turned off? But it must be turned off before he can begin, and every house on that main must be without water till he has done. At present, all supply-pipes which have a fall to the main, empty themselves when the water is turned off; and this is the reason that these pipes, although exposed to the frost, do not burst; but when they are kept full, how many of them will be found to have burst after a sharp frost! Surely, Sir, during a hard winter, the supply will be rather *inconstant*.

Under the present arrangement, if a cistern is out of repair, or the supply to a house is otherwise interrupted, a neighbour is applied to for a few pailfulls of water; but when all are served from the same cistern—that is, the reservoir—what is to be done? When there is no water at my tap, I shall know there is none at my neighbour's.

It is obvious that the supply cannot be, practically, *constant*, and therefore that there must be cisterns; and if there must be cisterns, what need is there to compel the companies to make the supply "what is called constant?"

But even theoretically, although the idea is pretty, what advantage is to be gained beyond the saving of a few cisterns? Is it worth while to incur such practical difficulties for the sake of a little satisfaction to a few centralizationists in realising the idea of unity? The first winter will dispel the illusion, and make every man prefer the *certainty* of a little *store* in his own house, to an intermittent supply ("called constant") from a reservoir; and therefore the *great* evil of cisterns and water-butts will not be removed by this condescending interference of the Legislature.

I am, Sir, yours, &c.,

A LANDLORD.

THE "CHUSAN" STEAMER.

The *Chusan*—built by Messrs. Miller, Ravenhill, and Salkeld, engineers, of Blackwall, and Glasshouse-fields, Ratcliff, London, for the Peninsular and Oriental Company—is the first vessel turned off the stocks at the new building establishment of that firm at

Low Water, near Newcastle-on-Tyne. She was tried under steam for the first time at the Lower Hope, on the Thames, March 31st, 1852.

Taking into consideration the amount of power used, together with all the other circumstances of the size of the vessel, &c., the result, as regards speed, may be considered so satisfactory as to be interesting to many of our readers, and we have therefore taken some pains to obtain the following information from an authentic source. The engines being applied to give motion, not to paddle-wheels, but to a screw, are applied to it *direct*—that is, without the intervention of wheel and pinion, and, in consequence, move at the unusual speed for marine condensing engines, with air-pumps attached, of 75 to 84 strokes per minute; yet, notwithstanding this high rate of speed in all their trials on the Thames, on the passage of the vessel to Southampton, and afterwards, they worked without that heating so common with the most carefully-made engines on first trials, or the smallest inconvenience of any kind. Much of this, independently of the accuracy of the adjustments and workmanship, may be attributed to the use of soft metal bearings and vulcanized India-rubber valves, both of which have been introduced wherever practicable in the engines supplied to this vessel.

The first trial of the *Chusan* was made at the Lower Hope, in the Thames, on Wednesday, March 31st, 1852, when the following results, as relates to the speed of the vessel, were obtained:

1st run	4′ 59″ =	12·040	
2nd do	6′ 55″ =	8·675 =	10·357
3rd do	5′ 17″ =	11·356 =	10·015
4th do	6′ 45″ =	8·889 =	10·122
5th do	5′ 40″ =	10·588 =	9·738
6th do	6′ 29″ =	9·254 =	9·921
		5)	50·153
			10·030 knots.

and 10·030 = 11·618 statute miles per hour.

The screw used on this trial had two blades, like those used in all the Admiralty vessels; its pitch was 15 feet 6 ins., and the diameter was 9 feet 8 ins., and the mean number of revolutions it made during the six runs was 84.

The trial of speed, the particulars of which are recorded above of the *Chusan*, was made, as has been stated, with a screw with two blades, and the experiment was made under very suitable circumstances as regards weather, and with a sufficient number of runs to insure a correct average.

A trial was made again with a screw with three blades on the 16th April, but under adverse circumstances as regards weather, and without a sufficient number of runs having been made to determine with precision the speed; but it appeared on four runs to have averaged 9·31 knots, the average number of turns of the screw being 75.

On her passage to Southampton from London, the run as far as Spithead was made at the rate of 10½ knots per hour, also with the screw with three blades.

Another trial was made in Stokes's Bay of four runs, again with a screw of three blades, when a speed of about 9·66 knots was obtained.

The dimensions of the vessel are as follows:

Length . . . . . 195 feet.
Breadth . . . . . 28 do.

and she is capable of carrying 450 tons of cargo, besides coals, and passengers, and machinery. She measures 725 tons.

The engines have cylinders—two of 39 inches diameter, each with a stroke of 2 feet; and the pressure of steam in the boiler was 10 lbs. per square inch above the pressure of the atmosphere when the trials were made. The engines are of an exceedingly compact construction, and occupy a very small space in the vessel.

The *Chusan* (the pioneer of the Australian mail service) took her departure from Southampton for Sydney, on Saturday, May 15th.

THE FIRE ANNIHILATOR.

Sir,—In your last week's Number is a letter from an "Old Fireman" commenting upon a most ridiculous report by a captain of a ship, of the wonderful effects of the "Fire Annihilator" when applied to extinguish a fire in the long boat. It is not my purpose here to reargue the much-vexed question, of whether this invention is as efficacious as water in its power over the element "fire," but simply to draw attention to the point where I think the "Fire Annihilator Company" are in error, and

that is, in endeavouring to push the merits of the invention too far; they should have confined themselves to the spheres in which their apparatus is really good and useful; namely, in dwelling-houses and warehouses (especially those built in compartments, as required by the Building Act), in the holds of ships and other places, where no immediate currents of air are likely to interfere with its operations if applied at the moment of an outbreak of fire. Take the case of a careless person having ignited the hangings of a bedroom in a private house, with one of the annihilators on the landing, with plain directions attached, to place it in the chamber and *shut* the door, there can be no doubt of its effecting the object for which it is designed; beyond this "example" taken and applied, as I have stated, in houses, warehouses or ships, all the rest is puff, and will only bring the invention into ridicule.

I will only further add, that I have no interest in what I have written beyond wishing well to any thing that will enable us to cope with such an enemy as fire, and I know that, under the circumstances above stated, this will.

I am, Sir, your constant Reader,

COMMON SENSE.

London, June 18, 1853.

SIR SAMUEL BENTHAM THE ORIGINATOR OF THE BLOCK MACHINERY.

In addition to the valuable testimony which Professor Willis has afforded in his Lecture (see *ante* page 287), may be adduced that of a gentleman conspicuous amongst the brilliant mechanical and scientific luminaries of the present day, who, in a recent letter thus expresses himself:

"Many were the opportunities I had the great good fortune to enjoy in listening to the results of the truly original, masterly, and systematic mind of Sir Samuel, as I had the happiness to be present on the occasion of his frequent visits to his dear friend, Maudslay, while busy in his little mechanical paradise of a mechanical workshop, in which I spent two of the most delightful and valuable years of my life as his private workman, there drinking in many a discussion when busy at my vice, while those two glorious fathers of modern mechanism held high discussions on the past and future of mechanical history. Many such discussions I have been present at, in which the history of that most important system of mechanism, the Portsmouth Block Machinery, was gone over. Now I wish I had had the power to have take down even the substance of such conversations, as it would, indeed, have furnished some very important pages in the history of mechanism, but the general impression is yet most distinct in my memory that Maudslay always gave to Sir Samuel the full and true credit of being *the originator* of the block machinery. As to some of the mechanical details, due and suitable credit was given to Brunel, to Maudslay himself, as well as to others who had contributed any hints on detail contrivances in the system of machinery in question."

On noticing in the same letter that the unreasonable demands of skilled workmen had led to the introduction of machines to supersede the need of handicraft skill, there is this passage: 'What wonders have in this respect been performed in engineering mechanism by the *slide-rest*, or, as I term it, the slide *principle*—one of the most beautiful and marked features of Sir Samuel's block machinery, that is, the grasping of the tool by an unfeeling, unflinching, iron hand, and guiding or constraining its movements in a definite direction by a slide or guide. It is simply by the extended application of such principles that we deal now with masses of obdurate metal with as much ease, and even greater precision, than were they little pieces of wood. Planing, slotting, paring, and shaping with a degree of truth and geometrical accuracy such as would make old Archimedes or Euclid's mouth water."

"I may say that Sir Samuel Bentham was the first who treated a mechanical subject in a philosophical spirit, and, by his high powers of generalization, setting forth PRINCIPLES which are now working perfect wonders for mankind. Nearly all the feats which we can now, and are now performing in the treatment of materials, *may be traced back to the block machinery contrivances*. It is this which causes us now to look upon this series of machinery with a most affectionate interest, and it is only want of thought and knowledge that prevents others from viewing them and their author in the same light. I trust that, between Pro-

fessor Willis and your own writings, that the veil which Sir Samuel's generosity and disinterestedness has allowed to cover their history, will be so far removed as to let these desirable machines, and their legitimate descendants, come forth in their true light before the world."

PARABOLIC PROPELLERS.—PIRSSON'S CONDENSER.

A very fine screw steamship, named the *Albatross*, built in Philadelphia, has come to our waters, and become a New York ship. On Wednesday, last week, she made a trip down our bay, with a number of invited guests, and we were happy to form a part of the company. This vessel is a beautiful craft, and has many new points about her worthy of consideration. The *Albatross* was designed and constructed under the superintendence of her owner, Ambrose W. Thompson, Esq., of Philadelphia, and she does credit to his inventive qualities. She formerly belonged to the line of steamers running between the cities of Philadelphia and Charleston, but the line has been discontinued for want of business. She has a propeller, named "Thompson's Parabolic Propeller."* It is geared to make nearly two revolutions for one stroke of the engine The screw is of an *expanding* pitch. The speed on the trip was at the rate of about 12 miles per hour. She is fitted with the patent condenser invented by J. P. Pirsson, C.E.,† of this city, and to this apparatus for marine steamers we would desire to direct public attention. There is a great loss of fuel and a great wear of boilers, by the use of the salt water, which is employed by all our steamships. When the water in the boilers is saturated to a certain degree, the brine has to be run off; this involves a great loss of heat. In the course of time serious incrustations gather in the inside, and this involves a loss of heat also, as the scale is a non-conductor. The incrustations have to be removed every voyage, and the boilers cleaned out, and this involves another heavy expense. If pure water could be employed at sea, all the heat which escapes with the brine, and all the evils and troubles of incrustations would be saved and remedied. But how can this be done? To carry fresh water for a voyage would require huge tanks; in fact, the vessel could not carry enough to serve for one voyage of a few days. If we consider that all the water employed goes into steam, and this steam, when condensed, is pure water, whether made from salt or fresh water, the reflection arises,—why not condense the steam, and use it over again for boiler feed? To do this, salt water would have to be used for condensing, and it must be applied to the outside of the condenser, to cool the steam by radiation. This is the principle of this *condenser* for sea steamers. The principle is not new; but the manner of making it effective and profitable, as invented by Mr. Pirsson, is; and the saving of fuel, by its use, is over 16 per cent. of coal. This has been fairly tested in the *Albatross* during the past year, in her passage to and from Charleston. The condenser is very compact, and does not occupy much room, and we cannot but desire that the owners of steam-ships would examine it with candour. We cannot describe its peculiar difference from that of Hall's, &c.; we have not room to do so, and, besides, every apparatus must be judged by its practical working—the only test of its utility and economy. There can be no doubt but an apparatus of this kind is much to be desired; the only questions to be settled are those of its economy and working qualities; and upon the testimony of Mr. Thompson, the *Albatross* has resolved these questions in favour of a saving of 16 per cent. of fuel, and the prevention of all incrustations; the whole economy cannot be less than 25 per cent.; this is a great gain.—*Scientific American, June* 2.

THE PORTLAND BREAKWATER.

A very interesting and novel engineering operation is in progress at the breakwater now in course of construction at this place, which is nothing less than the building of a bridge across, or rather into, the sea. In order to render the necessity for this intelligible, it will be better to describe the general design of the breakwater. This is intended to consist of two separate portions—the one extending from the shore into the sea about 1,900 feet, in an east-north-east direction; and the other about 6,000 feet in length, and isolated, the nearest point of which will ultimately be 400 feet from the inner portion. During the progress of the works, and until the pier-heads forming the ends of these arms are built, the necessary space for constructing them, and other contingent causes, will prevent the rough unfinished portion of the two arms approaching nearer to each other than from 800 to 1,000 feet. The stone with which the breakwater is formed is quarried by convicts; but the general execution of the same, requiring too much mechanical knowledge for such a class of men, is under contract. The stone (an admixture of rough large blocks, from six tons and under, mixed with a sufficient quan-

* In what respect does his differ from Hodgson's English parabolic?

† See Mech. Mag., vol. liv., p. 101.

tity of small ribble to fill the interstices) is tipped into the sea from railway wagons (without any attempt at regularity, with the exception of a due regard to a proper proportion of sizes), trains of which are hauled along the breakwater by locomotive engines. This mode of depositing the material renders its execution very cheap; and it is principally with a view of adopting this manner of construction on the outer breakwater that the bridge above alluded to becomes necessary. This is of course a timber structure, and, although only for what may be called a temporary purpose, is necessarily, both from its position and from the length of time it will have to remain, erected in a manner which would ordinarily be called permanent. The general depth of water at low water is about 57 feet, and the roadway being 25 feet above this level, it follows that the piles supporting it must be about 80 feet in length or height, and, as single timbers would be manifestly not obtainable, they are made like the masts of vessels, each weighing (when prepared with the necessary iron-work connected with it) about seven tons. The mode of fixing these in the ground is ingenious. They are shod with cast-iron shoes of Mitchell's patent, having a thread or worm upon them of a large pitch, which are screwed into the clay or shale by means of a capstan head, and bars fixed on the head of the piles. Each pile is supported in an upright position by very strong guys or stay rods, and upon these piles, which are in rows, 30 feet apart, the necessary superstructure for carrying three lines of railway and a horse-track is fixed, making a bridge of about 80 feet wide. A visit to these works would well repay any one who is interested in these matters, both from the magnitude of the work and the speed with which it is executed, the total length of 1,000 feet only taking about four months to do. The harbour of refuge at Portland is the largest now being constructed, under the recommendation of the Harbour Commissioners, appointed some few years back, and the works have been carried forward with great spirit. The breakwater staging is now approaching half-a-mile in length from the shore, and the part filled up with stone already affords very considerable shelter in the anchorage, the advantages of which are beginning to be felt by the masters of vessels, foreign as well as British. The works are being constructed for the Admiralty, under the superintendence of Mr. James M. Rendel, F.R.S., engineer in chief, and Mr. John Coode, resident engineer. Mr. J. T. Leather is the contractor for the same.—*The Times.*

SHIPBUILDING.—AMERICAN CHALLENGES.

[The first of the following challenges appears in the *Scientific American* (New York publication), and the second has appeared in most of the London newspapers.)

"I have been frequently asked, within the last week, as if I were well enough assured of the speed and sailing qualities of vessels built on my model, to build a vessel to race with one to be built on any other known model from which any vessel has heretofore been constructed?

"In answer to these inquiries, and to gratify the interest excited in the public mind in this country and in Europe, in relation to my new model for ocean and river vessels, I will make the following offer, which will be held ready for acceptance for one month from the first day of June:

"I will build and complete, within the period of six months from the first day of June, a schooner-rigged yacht on my new model, which shall be one hundred feet on deck, and when completed will cost about thirty thousand dollars; and I will sail her in a race with any other vessel that can be built within that period, on any other known model from which any vessel has heretofore been built; such vessels to be built the same length on deck, viz., one hundred feet. And this is the only point upon which they shall be controlled in dimensions, construction, rigging, or sails (except that the vessel shall be built of wood). And I will run my yacht in a race with any vessel so built that may be matched against her, after the period of six months from the first day of June, 1852, at any time and place, and under any circumstances that may be chosen by the other parties, whether such contest be upon the river or ocean, with or against the wind, in a heavy or light breeze. If my yacht is beaten, I will deliver her, with all her appurtenances, to the winner of the race as a prize, and if the opposing vessel is beaten, she shall be delivered to me, with all her appurtenances, as a prize.

"I will give them the further advantage of seeing at my office a lithographic drawing of the model, rig, and sails of the yacht I propose to build as she would appear upon the water. "Respectfully,

"DARIUS DAVISON.

"374, Broadway, New York, June 5th, 1852."

Darius Davison and Brother have formed an association to build yachts which they warrant to beat all others.

Mr. Davison's propositions have created no small excitement in our city, and throughout the country. He proposes to build a steamboat to run to and from Albany in one day; also a steamship to beat all others now in existence.

"The American Navigation Club chal-

lenges the shipbuilders of Great Britain to a ship race, with cargo on board, from a port in England to a port in China, and back. One ship to be entered by each party, and to be named within a week of the start.

"The ships to be modelled, commanded, and officered entirely by citizens of the United States and Great Britain respectively.

"To be entitled to rank A 1, either at the American offices or at Lloyd's.

"The stakes to be 10,000*l.* a side, satisfactorily secured by both parties, to be paid without regard to accidents, or to any exceptions; the whole amount forfeited by either party not appearing.

"Judges to be mutually chosen.

"Reasonable time to be given after notice of acceptance to build the ships, if required, and also for discharging and loading cargo in China.

"The challenged party may name.

"The size of the ships, not under 800 nor over 1,200 American registered tons.

"The weight and measurement which shall be carried each way.

"The allowance for short weight or over size.

"Reference may be made to Messrs. Baring, Brothers, and Co. for further particulars. "DANIEL C. BACON,
"President."

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JUNE 24, 1852.

ALFRED VINCENT NEWTON, of Chancery-lane, mechanical draughtsman. *For improvements in dyeing textile fabrics.* Patent dated December 10, 1851.

Claims.—1. The employment of continuous lines of contact-pressing surfaces for stopping out any required pattern in fabrics when submitted to the dyeing process.

2. The use of blocks or other pressing surfaces containing ornamental devices when applied in the manner and for the purpose set forth.

THOMAS MASTERS, of Regent-street, confectioner. *For improvements in obtaining and drawing off aërated and other liquids, and in charging vessels with gaseous fluids, applicable to vessels for holding solid matters, and also as a fastening for utensils and apparatus, and in holders for cigars.* Patent dated December 11, 1851.

1. The improvements specified under this patent consist in a mode of stoppering or closing bottles for containing aërated liquids, and also jars for holding solids, by the employment of a ring of mineralised India-rubber attached to a stopper, and acted on by a screw and nut forming part of the same, so as to be compressed into a groove or recess formed inside of the neck of the bottle or jar, and thus produce an air-tight joint. Another improvement in stoppers consists in covering the same with mineralised India rubber, which, being compressed when the stopper is introduced into a bottle or jar, produces a tight joint.

2. The patentee describes sundry improvements in apparatus for aërating liquids and for drawing off aërated liquids; also in taps for general purposes, which consist principally of various modes of applying elastic materials in constructing the same.

3. The improvements consist of a mode of preventing the entrance of water into jelly and other moulds for confectionary purposes by applying a band of mineralised India-rubber, which is slipped on and allowed to contract over the joint formed by the meeting of the cover with the bottom of the moulds.

4. The patentee describes an elastic fastening for keeping the brushes of knife-cleaning machines in contact with each other.

5. The "improvements in holders for cigars" consist in forming mouth-pieces to be used with the same from mineralised India-rubber, which is stated to be preferable to the vulcanised India-rubber for this purpose, inasmuch as it is destitute both of the unpleasant taste and smell which distinguish the latter.

THOMAS TWELLS, of Nottingham, manufacturer. *For certain improvements in the manufacture of looped fabrics.* Patent dated December 15, 1851.

The improvements claimed under this patent comprehend,

1. The manufacture of looped fabrics of a varying width by machinery actuated by power.

2. The manufacture of looped fabrics by the adaptation of separate and detached moveable slides to which the needles are fixed, in contradistinction to the rigid and arbitrary, or permanent combinations of needles employed in the ordinary stocking frame.

3. The use of a double tier of needles adapted to the same slides.

4. The application of the Jacquard apparatus for the manufacture of looped fabrics.

JOHN GEDGE, of Wellington-street, Strand. *For improvements in the treatment of certain substances for the production of manures.* (Being a communication.) Patent dated December 16, 1851.

This invention consists in the production of manures by treating stable-dung alone or mixed with straw, leaves, and vegetable matters with a solution of certain chemical

substances. The solution is composed by dissolving in eleven gallons of water 1lb. of the following mixture of ingredients; the proportions of which however may be varied:—

	lbs.	oz.
Sulphate of ammonia ..	8	12
Sulphate of potash......	16	10
Sulphate of soda	19	10
Sulphate of alumina	25	—
Sulphate (qy. of what ?)..	25	—
Sulphuric acid	5	—
	100	

Seventy-seven gallons of the solution will be sufficient for treating one ton of dung. The mixture may be applied in the open air, but it is preferred to perform the operation in the stable, as there is then less chance of the ammonia volatilizing. And in order to secure as large a portion of this ingredient to the lower strata of litter and dung, the floor of the stable should be made to retain the urine of the animals, instead of allowing it to run to waste. The stable-dung thus prepared is laid as a foundation for a manure heap to the depth of about 12 inches, over as large a surface as the heap is intended to cover; a layer of straw and vegetable matter to the depth of 3 or 4 feet is then piled on; then another of stable-dung, and so on till the heap is completed. As soon as fermentation takes place the manure is ready for use. The vegetable matters may be used in their green state or dry, in which case they should be well saturated with water. The chemical substances above named may be used in their dry state alone, or mixed with earth as a manure.

Claims.—1. The making of manure heaps, commonly called "dung-hills," as described, using the chemical combination set forth for that purpose.

2. The combination of chemical substances described, to be used alone, or mixed with earth or other pulverized matter.

FREDERICK WILLIAM NORTON, of Paisley, Renfrew, manufacturer. *For certain improvements in the manufacture or production of plain and figured fabrics.* Patent dated December 16, 1851.

Claims.—1. Certain systems or modes described of manufacturing or producing woven fabrics.

2. The manufacture and use of fabrics with a full or close covered warp surface produced by cross weaving over cords, or foundation threads, which form the interior body of the fabric.

3. A system or mode of producing woven fabrics, the surface of which is entirely formed by the warp closely and solidly covering the cloth surface, the weft not being required to appear thereon.

4. A system or mode of causing the surface warp to have the external appearance of weft shoots passed transversely across the piece.

5. A system or mode of producing woven fabrics wherein the surface warp threads are bound down on the two opposite sides of the foundation threads, and beaten up to form a firmer cloth with a full or solid surface.

6. A system or mode of forming the sheds for the passage of the weft, by elevating and depressing the surface warp threads above or below the level, and on each side alternately, of the foundation threads, the zig-zags so formed being afterwards beaten up by the reed to form a solid surface.

7. A system or mode of producing woven fabrics by causing the surface-warp threads to intersect each other.

8. A system or mode of manufacturing or producing ornamental fabrics by the adaptation of cross-weaving elongated pattern surface warp threads, to contract or take up such threads in the loom.

9. A system or mode of taking up elongated figures printed upon surface-warp threads by cross-weaving.

JAMES SOUTER and JAMES WORTON, of Birmingham. *For improvements in the manufacture of papier-maché and articles made therefrom, and in the manufacture of buttons, studs, and other articles where metal and glass are combined.* Patent dated December 17, 1851.

The *first* part of this invention has relation to the preparation of papier-maché and articles made therefrom for the process of japanning.

In place of immersing the papier-maché in oil, and then applying a coating of black-lead and the other usual ingredients, to receive the japan, the patentees reverse the process, and apply the black-lead coating previous to the immersion in oil, by which means much of the smoothing now necessary will be dispensed with; and an equally true surface produced. The black-lead coating is preferred to be made with paste, such as used by bookbinders, and white lead, flake white, or other pigments or matters may be introduced. The application of blacklead, in a state of powder, previous to immersion in oil, as a preparation for the process of japanning, is also stated to be useful in many cases.

The *second* part of the invention has relation to the manufacture of papier-maché buttons and beads, or other perforated articles. First, the patentees propose to manufacture such buttons and articles from discs of papier-maché by punches and tools suitably arranged for forming the buttons, and at the same time piercing, or partially piercing

the holes necessary for their attachment to articles, and they consider it an improvement to make the buttons with two or three holes only; the buttons thus made are finished in the usual way, or according to the method firstly described. Secondly, the patentees produce such buttons by moulding them from the pulp. Third, they apply a disc of metal at the centre of the papier-maché buttons, to give strength to the parts where the holes are pierced. And fourth, they ornament papier-maché buttons by inlaying them with mother-of-pearl or other ornamenting shell, or with metal,—the methods of doing which will, in this case, be the same as are employed for inlaying other articles of papier-maché.

The *third* part of the invention consists in manufacturing buttons, studs, and other articles where glass and metal are combined, in order to give the same the appearance of jewels set in metal. This has been effected by applying perforated pieces of metal in front of pieces of glass, cast or formed with projections, which were made to protrude through the perforations of the metal. The patentees, however, adopt the plan of casting the glass on to perforated pieces of metal, by which means a more perfect adherence between their surfaces will be obtained. The perforated pieces of metal are placed in the bottoms of moulds, and the glass is poured or pressed in so as to pass through the perforations, and assume the forms of the recesses in the moulds.

Claims.—1. The improvements described in the manufacture of papier-maché and articles made therefrom.

2. The improvements described in manufacturing perforated papier-maché buttons and beads, or such like perforated articles.

3. The improvements described in the manufacture of perforated papier-maché buttons, by inlaying the same with shell or metal.

4. The improvements described in manufacturing buttons, studs, and other articles where metal and glass are combined.

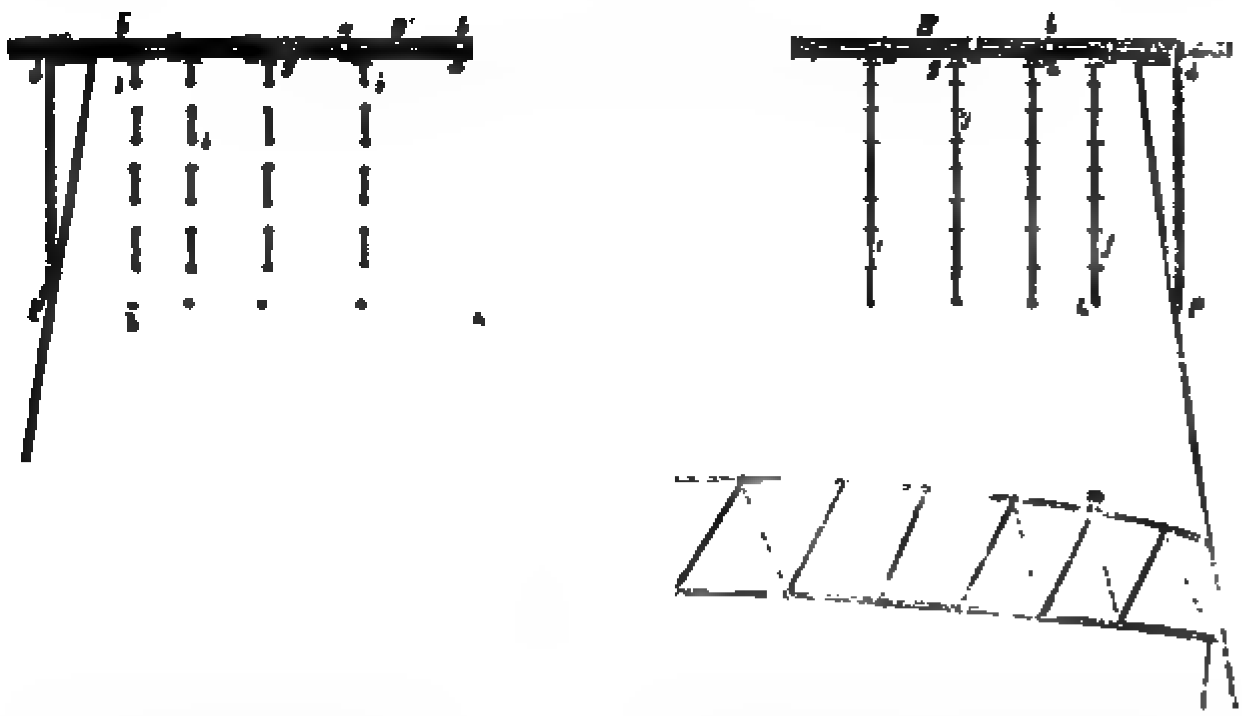
CHARLES LAMPORT, of Workington, Cumberland, ship-builder. *For improvements in reefing sails.* Patent dated December 19, 1851.

This invention has for its object to effect the reefing and unreefing of the sails of ships from the deck, whereby the following advantages, among others, are obtained; namely, increased celerity and safety in manœuvring, reef tackles are dispensed with, and the reef can be taken in and shaken out without altering the position of the sail, as regards the vessel's course. And the manner in which this is effected is as follows: First, the sail is attached to the yard by a tube or tubes of galvanized wrought iron or other metal in the way represented in figs. 1, 2, and 3. The tubes *t t*, are fastened to the yard by lugs or projections *a a*; which are passed through holes in the sail, and then through slots in hoops *b b*, fig. 2, which encircle the yard B, the tubes being secured by pins on the inside of the hoops. To allow the ready insertion of these pins, and to prevent injury to the sails, the yard is slightly hollowed out at *c c*. In the centre opposite the mast the tubes are parted to the extent of a few inches, that is, to about as far as the pulleys *e e*, and at each side they are extended a little beyond the head of the sail, in order to keep the sail stretched when reefed. Thus the sail is attached between the yard and the tubes, and the head rope of the sail bears equally and continuously along the whole extent of both. Next a small chain is passed through the tubes, which chain runs downwards over a small pulley *d*, figs. 1 and 2; at the outer end at the cleat of the yard, and under the centre pulleys *e e*, which are firmly fixed to the yard by stout hoops, and secured by a plate connecting the two centre pins. The removal of these centre pins allows the chain to clear the yard when the sail is detached; so that in fact the chain-tubes and chain, all connected therewith, may at any time be removed at once without separation and without trouble. The outer end of each chain is attached to the reef cringle, in the leach rope, by a common shackle as at *p p*, fig. 3. A series of eye-bolts may be substituted for the tubes, or the chain may be merely carried over the pulleys attached to the yard, but the tubes are preferred as easier to work and less liable to derangement. The inner ends, after passing under the pulleys *e e*, are connected together by a single rope or chain, carried over a pulley, or through an eyebolt in the mast-head, down to the deck. At convenient distances along the tubes, holes are made on the upper and lower side as at *f* and *g*, fig. 1, to allow of reef points or small cords being passed into the tube from below, while the holes above will enclose them, to be fastened by a simple knot or otherwise to the chain. The other ends of the cords are sewed to the sail, as far down as the depth of the reef at *h h h*, fig. 3, after passing through small thimbles at *i i i*, attached to the sail at convenient distances apart, in order to keep the sail, when reefed, in straight even plaits. These thimbles may either allow the cords to pass through the sail backwards and forwards, as at *i i i*, or may be kept altogether on one side, as shown at *j j j*. By these means the common "jackstay" may be dispensed with, and the sail can be bent and unbent, in much less time than by the ordinary method.

To reef the sail, the only thing to be done is to secure the chain, or rope K to a bolt, or belay pin on deck, and then lower the yard. As the yard descends, the chains are drawn through the tubes, and the cords, or reef points along with them, until the reef is gathered up in regular even plaits or folds tight and firm against the yard and tubes. To shake out the reef, all that is required is to cast off the rope K on deck, and hoist the yard again. When the reef is taken in, the common earing may be passed, and the ordinary reef points tied, if thought desirable, without difficulty or danger to the men. In fine weather the chain may be detached from the cringle and secured to the yard.

Fig. 1.

Fig. 2.



To take in a second reef, another set of tubes must be fixed on the aft side of the sail with a chain and points, extending as low down as required.

A modification of the preceding arrangement may be made by attaching a second foot-rope at any convenient distance from the foot of the sail, and lacing a small cord through thimbles let into the sail at *m m*, fig. 3, the ends of which may be carried to the deck, either at the cleats of the yard along with the "sheets," or direct from the middle of the sail. By lowering the topsail yard, and hauling on the said small cords, the sail will be gathered up in a bundle at the foot.

It may occasionally be found expedient to use a portion only of the mode of reefing and unreefing just before described; that is to say, the reef may be first gathered up by that method, and then the earing may be passed, and the common reef points tied as at present.

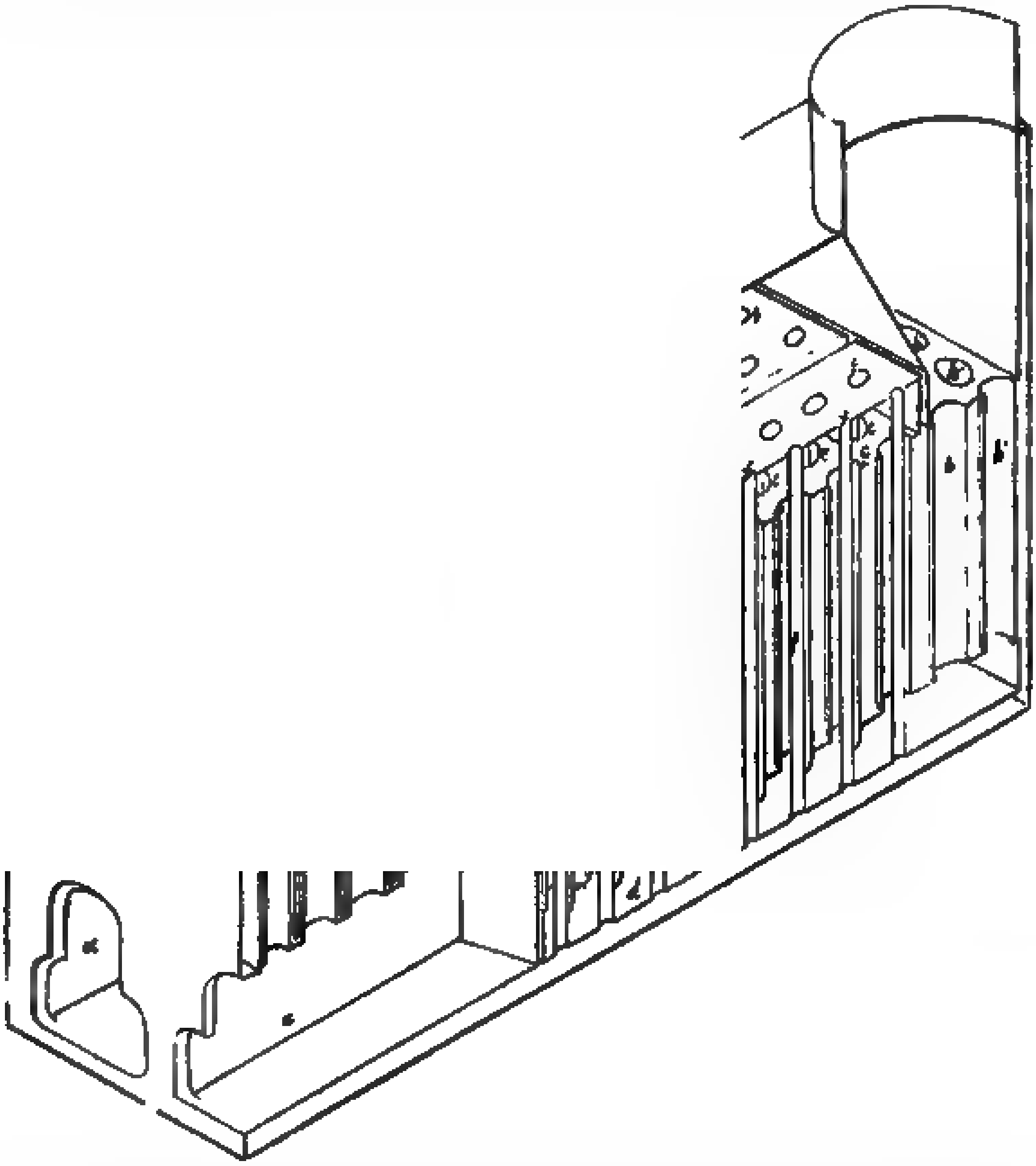
The patentee assumes that it would, in most cases, be deemed preferable to effect the reefing and unreefing from deck, but it will be understood that he does not limit himself in this respect.

Claim.—The mode of reefing and unreefing the sails of ships by means of chains or cords worked from the deck, or elsewhere, as before described; that is to say, in so far

as regards the attaching of the sails to the yards by means of tubes, or other analogous means (instead of tying or seizing as usual), the lowering of the yards, and thereby effecting with the aid of chains or cords passed through the said tubes, the reefing and unreefing, and also the employment (in certain cases) of an additional rope or ropes across the foot of the topsail, and gathering up or folding together any portion of the foot of the topsail by way of reef, by means of cords, chains, or the other ties leading to, and accessible from the deck.

WILLIAM EMERY MILLIGAN, of New York, mechanical engineer. *For certain improvements in the construction of boilers for generating steam.* Patent dated December 19, 1851.

The nature of this invention consists of a new arrangement of flues, tubes, and water spaces within a boiler for generating steam, whereby a much larger amount of surface is exposed to the action of heat than usual. In its general external appearance this improved boiler is similar to ordinary boilers; neither does it differ materially from others in regard to the construction of the enclosed furnace (considered by itself), but upon the upper side of the fire-place *a* are placed a series of flues *bb* (fig. 1) of a number and capacity sufficient to carry off readily the products of combustion from the furnace. These flues open into a horizontal



flue *c*, which is placed above the furnace and below the water-line of the boiler. At the back of the furnace *a*, and near to the bottom of the boiler there is another horizontal flue *d*, and between the two horizontal flues there is a series of vertical flues, similar to the flues *b*, but necessarily longer, as shown at *e*, and these latter flues are for the purpose of conveying the products of combustion from the upper to the lower

horizontal flue. Through the centre of each of the vertical flues *e*, is introduced a tube *f*, say of one half the diameter of the flue, which tubes extend from the upper tube sheet of the horizontal flue *c*, through the lower tube sheet of the flue *d*, as shown. The water passes through these tubes, which serve the purpose not only of presenting greater surface for the absorption of heat, but insure the circulation of the water within the boiler. From the lower horizontal flue *d*, the products of combustion are conveyed into the chimney by means of the flues *b′* as shown. One, two, or more furnaces provided with flues and tubes thus constructed and arranged, may be placed within the same shell, sufficient space being left between them, as shown, for the circulation of the water.

The practical result of this improved system is as follows: The water in the boiler rising above the upper horizontal flue fills the tubes *ff*, and surrounds all the flues. The products of combustion pass from the flue *c* through the vertical flues *ee*, parting with their heat on the one side to the immediately surrounding water, and on the other to the water within the tubes *ff*. The water contained in the tubes is much more rapidly heated than that surrounding the flues, as its volume is less, and hence by known laws a regular and perfect circulation takes place within the boiler.

The flues *cc* and *dd* may be placed vertically, and the others horizontally, or *vice versâ*, and though preferring the disposition of the parts represented in the drawings, the patentee does not restrict himself to it, but claims generally the arrangement of the tubes and flues in such manner that the water tubes shall be connected with an upper and lower tube sheet, in combination with flues of less length than the tubes, as also the connecting of the said tubes with an upper and lower flue sheet, whereby two horizontal flues are formed in such connection with each other by means of vertical flues, that the products of combustion from the fireplace shall pass into the upper horizontal flue, and thence down the vertical flues into the lower horizontal flue, parting with their heat on the one hand, by radiation through the flues, to the immediately surrounding water spaces, and on the other, through the tubes, to the water circulating through them, all as before exemplified and described.

Christopher Rands, of Shad Thames, miller. *For improvements in grinding wheat and other grain.* Patent dated December 19, 1851.

These improvements have relation to the construction, suspending, and ventilating of mill-stones. The mill stones are of an annular shape, that is, they have the centre part (where the surface speed is slowest) removed so as to leave an opening at the centre large enough to receive a fan by which the ventilation is effected. The upper stone is suspended in a circular frame by two axes at the opposite sides, and this frame again is suspended by axes at right angles to the others, by which means the stone is hung in the same way as a mariner's compass, with full power of adjusting itself, so as to maintain constant contact between its surface and that of the under stone, which is the one the patentee prefers to drive. The under stone is suspended in a similar manner, but the axes supporting it are on the inside, instead of being, as is the case with the upper stone, on the outside. The fan is driven by a band from a vertical shaft which receives its motion by a band from the shaft driving the runner stone. The corn, in a bruised state, is fed in at the centre of the stones on to a plate on a level with the top of the runner stone, and is driven with the air from the fan between the stones, from whence, after being ground, it is delivered by a spout in the usual way.

William Elliott, of Birmingham, manufacturer. *For improvements in the manufacture of covered buttons.* Patent dated December 19, 1851.

1. Mr. Elliott proposes to employ in place of the plain rings ordinarily used in forming the backs of die and pressure-made covered buttons with flexible shanks, rings or shells, having their internal edges serrated or jagged, so as to hold more securely the flexible fabric of which the shank is formed.

2. In making die and pressure-made buttons with covered backs, Mr. Elliott proposes to use a disc of metal serrated at the edges instead of plain as usual, the object here also being to enable the flexible covering to be more securely held. This method is particularly applicable to the making of linen-covered buttons, which would be attached by sewing the flexible back to the garment instead of sewing through and through.

Claims.— 1. The application of back shells or rings, with serrated openings, in the manufacture of die and pressure-made covered buttons with flexible shanks.

2. The application of metal discs with serrated edges in the manufacture of die and pressure-made buttons having covered backs.

John Thornton and James Thornton, both of Melbourne, Derby, mechanics. *For improvements in the manufacture of meshed and looped fabrics and other weavings; and in raising pile on looped fabrics and other weavings.* Patent dated Dec. 19, 1851.

Claims.—1. The combining machinery and producing thereby a certain manufacture of meshed fabrics.

2. The manufacture of piled warp fabrics by making pile on both sides of the fabric when the same is being produced by warp machinery.

3. The manufacture of piled fabrics with the rows of pile of different lengths.

4. The manufacture of felted knit fabrics [with a felting yarn composing the body of the fabric, and the pile formed of a yarn or material, such as silk, not capable of being felted].

JOSEPH BURCH, of Craig Works, Macclesfield. *For improvements in printing and manufacturing cut-pile, and other fabrics and yarns.* Patent dated Dec. 19, 1851.

The *first* improvement described by the patentee consists in combining the processes of printing and embossing, or embossing and printing, for ornamenting cut-pile fabrics. The design or pattern is first printed on the fabric, and the process of embossing is then applied to give finish and increased effect to the printed pattern. When the embossing is performed previous to the colour being applied, the printing must be done in opaque colours, as the effect would be spoilt if it were necessary to employ any raising or clearing process to the printed pattern.

The *second* improvement consists in subjecting cut-pile fabrics to the action of steam previous to their being submitted to embossing—the object being to soften the fibres, and render them more capable of being acted on.

The *third* improvement consists in the application of the patentee's block-printing apparatus to hand printing, with suitable means of ensuring accuracy of effect without regard to the manual dexterity of the operator. The fabric is supported on a travelling sheet, from the surface of which project pins or points to keep it in position, and is passed under the action of each block successively, the colour being applied to the blocks by rollers revolving in colour sieves. In order to ensure the carrying cloth travelling in a straight line, one side of it has a non-elastic band running on guide rollers, and the fabric under operation is held to the cloth by clasps.

Claims.—1. The mode of combining and using the processes of embossing and printing, or printing and embossing in the manner described.

2. The mode of passing woven fabrics through a steam chamber before the process of embossing.

3. The mode of using the combination of hand block apparatus described.

4. The mode of using surface blocks with sliding frames, and furnishing sieve rollers in connection with hand printing.

5. The mode of using, in connection with hand printing, an endless cloth with non-elastic bands, having guide rollers for guides, stud-holes for studs, holding-down clasps, and pinpoints, for the purposes described.

HENRY CLAYTON, of Atlas Works, Upper Park-place, Dorset-square. *For improvements in the manufacture of tubes, pipes, tiles, and other articles made from plastic materials.* Patent dated December 19, 1851.

Claims.—1. The construction of moulds or dies composed of two plates forming a box or chamber, the inner or upper plate having an aperture opening into the material cylinder or box, and the outer or lower plate forming, or having affixed to it, the die; the moulding orifice corresponding with the external diameter of the intended tube, pipe, or other article, and the dod or core, being sustained by a bar or bars, attached to the inner or top plate, so as to leave an uninterrupted space between the rod or aperture of the die, or over the moulding orifice.

2. The supporting of the dod or core, by means of a stem passing through the piston or forcing plate, and attached to the upper part of the framing of the machine, thus forming the moulding orifice of the die, with the dod or core concentric with the orifice of the die, without being carried by any bar or bars in connection with the die-plate, or over the moulding orifice of the same.

3. The construction and use of dies or moulds for the formation of pipes, tubes, or tiles with an enlargement or thickening of material, the die or mould having a door or flap for closing the outer end thereof, during the formation of such enlargement or thickening. Also, the employment of conical perforations for the admission and escape of air to and from the moulds or dies.

4. A combination of means and apparatus for forming square, rebuted, or other forms of joints to pipes, tubes, tiles and other articles, by cutting away suitable portions of the materials previous to burning such articles.

FREDERICK BOUSFIELD, of Devonshire-place, Islington, gentleman. *For a new manufacture of manure.* Patent dated December 19, 1851.

This invention consists in manufacturing manure from blood. The patentee takes the blood of cattle, sheep and pigs from the slaughterhouses, and having separated the fibrine by stirring, he places the blood in evaporating pans, and applies heat until it

is reduced to a thick consistence. The heat should vary between 120° and 165° Fahr., and should not be raised to the boiling point, as some of the constituents of the blood are by so great a heat rendered insoluble, and deprived of their valuable properties. When the consistence of the blood is such as to admit of its being removed from the evaporating pans, it is spread on shelves or on the floor of a room to dry, and currents of heated air are caused to pass over it to facilitate this operation, care being taken to stir it, in order to prevent the formation of lumps, and cause it to dry in a powdery state. Or it may be subjected to pressure before being placed on the shelves to dry, and immediately after its removal from the evaporators. The powder thus obtained is applied to agricultural purposes, in the same manner and proportions as guano and such like manures. The extent of dryness given to the blood to convert it to manure may be varied, but the patentee recommends that the processes of evaporating should be carried on until the blood loses in weight about 65 to 75 per cent.

Claim.—The manufacture of manure from blood in the manner described.

SAMUEL WILKES, of Wolverhampton, brass-founder, *For improvements in the manufacture of kettles, saucepans, and other cooking vessels.* Patent dated December 19, 1851.

These improvements consist in manufacturing kettles, saucepans, and cooking vessels from sheet brass, by raising the same by a succession of operations with suitable dies and tools, and then using dies and pressure to complete the formation of the article. The discs of metal are submitted to a pressure between dies until raised to the required shape, being annealed between each operation, and the saucepans or kettles thus formed are tinned on the inside, and have handles fitted to them in the usual way. The brass which the patentee prefers is that known as Muntz's metal, consisting of 40 parts zinc to 60 parts copper, or nearly so.

Claim.—The manufacture of kettles, saucepans, and other cooking vessels, as described.

MOSES POOLE, of London, gentleman. *For improvements in apparatus for excluding dust and other matters from railway carriages, and for ventilating them.* (Being a communication.) Patent dated December 19, 1851.

This invention consists in applying to the upper part or roof of railway carriages horizontal tubes, with bell mouths arranged so as to catch the air while the carriages are moving forwards, and direct it into the interior of the carriages. The mouths of the tubes are covered with wire gauze, and they are placed so as to be in connection at their lower ends with tanks containing water, on which the entering air impinges,—the water acting as a spark and dust arrester. The current of air is divided into streams on its entrance into the carriages by passing through wire gauze screens. In order to produce an outward current of air the patentee adapts to the carriage what he calls "deflectors," or "deflecting windows," which are composed of vertical panes of glass, or slats of wood or metal, set at an angle of 45° with the central line of the carriage, and mounted so as to be capable of being turned in either direction, according to the way the carriage is moving. The air displaced by the flat sides of these panes while the carriage is in motion acts on that in the interior so as to cause a current in an outward direction. Or the windows may be composed of a single moveable sash, or of two sashes, hinged either at the sides or to a central rail.

Claims.—1. The use of tanks or vessels of water or other fluid in combination with or as parts of ventilators, for the purpose of catching and holding dust, sparks, cinders, and other matters, and thereby preventing their entrance into the interior of railway carriages.

2. The construction and use of deflectors or slats or thin flat pieces of wood, glass, metal, or other rigid material, placed in the sides of railway carriages, for the purpose of deflecting the air from the openings or apertures in the sides of the railway carriages.

3. The construction and use of deflecting windows for the same purpose.

4. The use of deflectors and deflecting windows, in combination with ventilators placed in, or upon, or near, the roofs or tops of railway carriages.

WILLIAM HIRST, of Manchester, manufacturer. *For certain improvements in machinery or apparatus for manufacturing woollen cloth and cloth made from wool and other materials.* Patent dated December 19, 1851.

The novelty of this invention consists in facing one or both sides of a piece of inferior woollen cloth, flannel, or similar fabric with a layer of wool, or wool mixed with other felting materials, thereby producing at less cost an article which, when raised, shorn, and finished, is equal in gloss and appearance to the best woven cloth.

The machinery employed for this purpose consists of a perforated table or grate, which may be of any convenient length and width, and a platen or flat surface of the same size as the table, which occupies a position above

it, and is capable of being raised and lowered, as well as having a reciprocating motion on the surface of the table. A series of steam jets are placed in the perforations of the table for the supply of steam during the operation, to cause the felting and incorporation of the layers or facings of wool with the body of the fabric.

The mode of operating is as follows:—The platen having been raised from the table, a layer of wool, or wool and other felting material is placed thereon. A length of the cloth to be faced (which may be of an inexpensive description) is then laid on the fleece of wool, and another layer or fleece of wool is spread on the surface of the cloth. The platen is then lowered and set in motion, the steam being meanwhile turned on at the jets, and the motion of the platen is continued and assisted by pressure if thought requisite, until the desired effect is produced. The faced cloth is then removed, and subjected to the usual operations of milling or fulling, raising, shearing, and finishing.

Claim.—The peculiar arrangement and construction of mechanism described, whereby is manufactured or produced a fine cloth, flannel, or other similar fabric made of wool, or wool and other materials, capable of being raised, shorn, and finished, for the purpose of forming a surface similar in gloss and appearance to the woven wollen cloth or fabric.

RODOLPHE HELBRONNER, of Regent-street. *For improvements in apparatus used when obtaining instantaneous light.* Patent dated December 19, 1851.

1. For the purpose of obtaining instantaneous light, whether for lighting lamps, or cigars and other similar uses, the patentee prepares strips of cotton wadding rolled together, or fibrous materials similarly rolled and cemented on the outside with paste, gutta percha, or other material with which has been mixed saltpetre, or any suitable acetate, nitrate, or chromate. These strips he dots or spots with phosphoric mixture at intervals apart, corresponding to the length of time they are required to burn. He then places a strip so prepared in a tube or case which has a slot or opening down the side, and a traveller or slide for protruding the strip of material from the case when required to be ignited. When a flame is desired to be produced, the strip of material is coated with stearine, wax, or other combustible material before applying the phosphoric mixture.

2. For the purpose of applying the phosphoric mixture, a frame is prepared composed of a number of splints or slips of wood of a bellying form at the middle of their length, held together by transverse stays. This frame is dipped into the mixture, and a number of lengths of material having been laid together, the mixture is deposited on them at distances apart, corresponding to the intervals between the slips by applying the frame transversely to the collection of lengths of prepared material.

Claims.—1. The causing of the material to be attached to a travelling slide in a tube or case, and causing the material to ignite as explained. Also, the peculiar manner of spotting or depositing the phosphoric mixture at intervals, so as to obtain continued light.

2. The arrangement described of placing the lengths of material. Also, the form and use of the instruments for depositing the phosphoric mixture upon the materials prepared to receive them.

CHARLES HOWLAND, of New York, engineer. *For improvements in apparatus for ascertaining and indicating the supply of water in steam boilers.* Patent dated December 19, 1851.

This apparatus or indicator is composed of a metal casing or cylinder, attached by flow pipes to the head of a steam boiler in such a position that the water of the boiler passes into the casing, and maintains therein the same level as in the boiler. At the top of the casing is fixed a glass tube, closed at its upper end, and communicating at its lower end with the interior of the casing. A float is placed in the casing, and has attached to it a stem, which passes upwards into the hollow of the glass tube; and the height of water in the boiler is shown by the position of the float stem in the glass tube, the float and stem rising and falling in the casing according to the rise or fall of water in the boiler. In order to give the alarm when the water is at a dangerously low level, the float is made, on descending to the bottom of the casing, to act on a lever which opens a valve, and permits the escape of steam into a whistle in connection with the apparatus, by the sounding of which the alarm is given, and the attendant warned that the boiler requires replenishing.

Claims.—The use of a cylinder having an indicator tube, in combination with a float having an indicator stem attached thereto for working in the glass indicator tube, and indicating the water-line in steam boilers. Also, the use of the steam escape pipe, valve, and lever arrangements described as a combination, and their combination with the cylinder and float and alarm or steam whistle.

JAMES FREDERICK LACKERSTEEN, of Kensington-square, civil engineer. *For*

improvements in machinery for cutting or splitting wood and other substances, and in the manufacture of boxes. Patent dated December 19, 1851.

1. The patentee describes an improved form of chisel to be used for splitting wood. It is composed of two wedge-shaped parts attached to each other at a right angle, and in this respect only does the chisel differ from the V-shaped cutter used by engravers, the sides of which are placed at an acute instead of a right angle. Several of such chisels, when arranged diagonally in a frame, constitute an apparatus for splitting blocks of wood into splints for fire-wood. The chisels, instead of being made with their cutting edges of equal width, and forming the two sides of a square, may be made with the cutting edges of unequal width—that is, to form two sides of an oblong; and such cutters may be arranged diagonally in a frame, to constitute a splitting apparatus. Or a combination of acute, obtuse, and right-angled sided chisels may be employed. Cutters of the same form are also adapted for machinery for slicing or chopping vegetables, and when the vegetables are required to be reduced to cubes or small pieces, a second set of straight knives are employed, which make their cut at right angles to the vertical angular knives.

2. An arrangement of feeding belt is specified, to be employed in connection with two or more circular saws mounted on the same spindle when employed for cutting planks of wood (principally across the grain) into lengths. The feeding belt is provided with a catch which, during a certain part of its revolution, remains in a state of inaction, until pretruded by a rod to catch hold of and draw forward against the saws the plank placed upon the belt.

3. The patentee describes several arrangements of flax and straw-cutting machines. The principal feature of novelty is the employment of disc cutters, mounted on parallel spindles, with their edges bearing against each other so as to act like shears. The straw, flax, &c., is fed on to a revolving endless carrying sheet, and is carried forward against the cutters, by which it is severed into lengths corresponding to the distances apart at which the cutters are mounted on the spindles.

4. The patentee describes an arrangement of chaff-cutting machinery in which the knife has a compound to-and-fro horizontal and vertical movement similar to that given by a parallel ruler. The straw or litter is supplied at regular intervals by an intermittent feed movement.

John Davis Morries Stirling, of Black Grange, North Britain, Esq. *For certain alloys and combinations of metals.* Patent dated December 22, 1851.

In the specification of a former patent, dated January 31st, 1851, the patentee described a method of coating iron with tin, after having been previously coated with zinc. The first of the present improvements consists in previously depositing on the iron a coating of copper (which may be done by immersion in a solution of a salt of copper), and then coating with zinc to receive the tin, which is applied in a melted state.

Another improvement consists in coating iron so covered with copper with a coating of tin; and a third improvement consists in using zinc, instead of tin, as a covering for iron coated with copper. The patentee prefers the use of a saline instead of an acid solution for cleansing the surface of the metal previous to immersing in the melted zinc or tin, and he uses a solution of sal ammoniac for this purpose. He also rolls the iron coated with copper before applying a covering of another metal, but regulates the pressure so as not to cause brittleness.

Another improvement consists in combining with hardened lead a covering of tin, or alloy of tin, so as to produce a metal suitable for use as a substitute for Queen's metal, Britannia metal, British silver, or pewter. For this purpose the patentee takes a slab of hardened lead, which he rolls to any required thickness and quite smooth; he then places a sheet of tin or alloy thereof on the surface of the lead, and passes them through the rolls, using at first a pressure just sufficient to bring them into close contact, and applying what is technically called "a severe pinch," so as to complete the union of the metals. The compound sheet may then be rolled to any required thickness. For the purpose of hardening the lead used as above, the patentee prepares an alloy of equal parts of tin and zinc melted together, and adds five parts thereof to every ninety-five parts of lead, stirring the metals well to produce perfect incorporation of the alloy. Or the hardening may be effected by the use of antimony in the proportion of from one part in fifteen to one part in nine of the lead. Or arsenic may be used with the lead for the same purpose, in the proportion of from one to two parts per cent.

Another improvement consists in coating zinc with lead, or the ductile alloys of lead, by pressure. Lead, hardened as first described, may be also used.

Another improvement is the combining of zinc or tin, or the ductile alloys of either of these metals with cadmium. The metals are rolled into sheets, and passed through the rolls in contact with each other, by which their union is effected.